No. 8106

JVC Service Manual

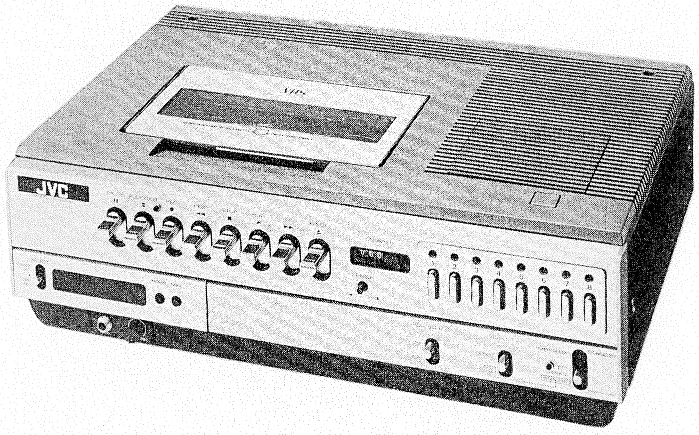
VIDEO CASSETTE RECORDER

MODEL HR-3300E

VICTOR COMPANY OF JAPAN, LIMITED

No. 8106

JVC Service Manual



MODEL HR-3300E

VICTOR COMPANY OF JAPAN, LIMITED

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Important Safety Precautions

Prior to shipment from the factory, JVC products are strictly inspected to conform with the recognized product safety and electrical codes of the countries in which they are to be sold. However, in order to maintain such compliance, it is equally important to implement the following precautions when a set is being serviced.

● Precautions during Servicing

1. Locations requiring special caution are denoted by labels and inscriptions on the cabinet, chassis and certain parts of the product. When performing service, be sure to read and comply with these and other cautionary notices appearing in the operation and service manuals.

2. Parts identified by the ⚠ symbol and shaded (▨) parts are critical for safety.
   Replace only with specified part numbers.
   Note: Parts in this category also include those specified to comply with X-ray emission standards for products using cathode ray tubes and those specified for compliance with various regulations regarding spurious radiation emission.

3. Use specified internal wiring. Note especially:
   1) Wires covered with PVC tubing
   2) Double insulated wires
   3) High voltage leads

4. Use specified insulating materials for hazardours live parts. Note especially:
   1) Insulation Tape
   2) PVC tubing
   3) Spacers
   4) Insulation sheets for transistors

5. When replacing AC primary side components (transformers, power cords, noise blocking capacitors, etc.) wrap ends of wires securely about the terminals before soldering.

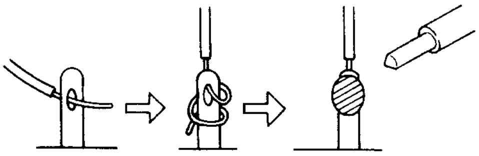


Fig. 1

6. Observe that wires do not contact heat producing parts (heatsinks, oxide metal film resistors, fusible resistors, etc.)

7. Check that replaced wires do not contact sharp edged or pointed parts.

8. When a power cord has been replaced, check that 10–15 kg of force in any direction will not loosent it.

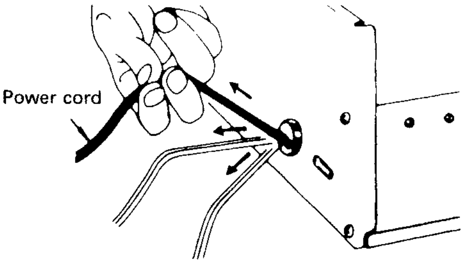


Fig. 2

9. Also check areas surrounding repaired locations.

10. Products using cathode ray tubes (CRTs)
    In regard to such products, the cathode ray tubes themselves, the high voltage circuits, and related circuits are specified for compliance with recognized codes pertaining to X-ray emission. Consequently, when servicing these products, replace the cathode ray tubes and other parts with only the parts specified. Under no circumstances attempt to modify these circuits. Unauthorized modification can increase the high voltage value and cause X-ray emission form the cathode ray tube.

11. Crimp type wire connector
    In such cases as when replacing the power transformer in sets where the connections between the power cord and power transformer primary lead wires are performed using crimp type connectors, if replacing the connectors is unavoidable, in order to prevent safety hazards, perfomr carefully and precisely according to the following steps.
    1) **Connector part number** : E03830-001
    2) **Required tool** : Connector crimping tool of the proper type which will not damage insulated parts.
    3) **Replacement procedure**
       (1) Remove the old connector by cutting the wires at a point close to the connector.
       Important : Do not reuse a connector (discard it).

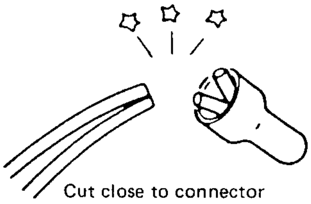


Fig. 3

(2) Strip about 15 mm of the insulation from the ends of the wires. If the wires are stranded, twist the strands to avoid frayed conductors.

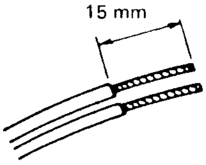


Fig. 4

(3) Align the lengths of the wires to be connected. Insert the wires fully into the connector.

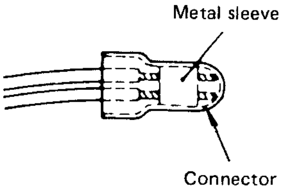


Fig. 5

(4) As shown in Fig. 6, use the crimping tool to crimp the metal sleeve at the center position. Be sure to crimp fully to the complete closure of the tool.

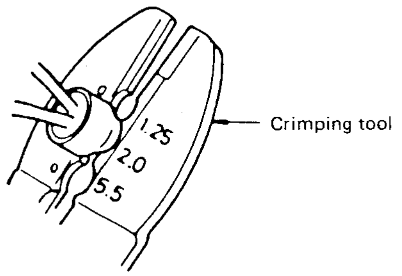


Fig. 6

(5) Check the four points noted in Fig. 7.

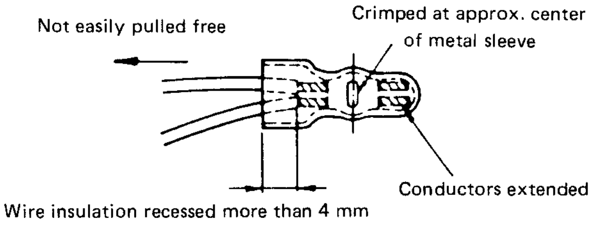

Not easily pulled free
Crimped at approx. center of metal sleeve
Conductors extended
Wire insulation recessed more than 4 mm

Fig. 7

●Safety Check after Servicing

Examine the area surrounding the repaired location for damage or deterioration. Observe that screws, parts and wires have been returned to original positions, Afterwards, performe the following tests and confirm the specified values in order to verify compliance with safety standards.

1. **Insulation resistance test**
   Confirm the specified insulation resistance or greater between power cord plug prongs and externally exposed parts of the set (RF terminals, antenna terminals, video and audio input and output terminals, microphone jacks, earphone jacks, etc.). See table below.
2. **Dielectric strength test**
   Confirm specified dielectric strength or greater between power cord plug prongs and exposed accessible parts of the set (RF terminals, antenna terminals, video and audio input and output terminals, microphone jacks, earphone jacks, etc.). See tabel below.
3. **Clearance distance**
   When replacing primary circuit components, confirm specified clearance distance (d), (d') between soldered terminals, and between terminals and surrounding metallic parts. See table below.

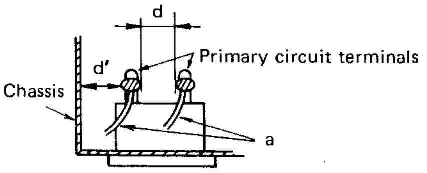


Fig. 8

4. **Leakage current test**
   Confirm specified or lower leakage current between B (earth ground, power cord plug prongs) and externally exposed accessible parts (RF terminals, antenna terminals, video and audio input and output terminals, microphone jacks, earphone jacks, etc.).

Measuring Method: (Power ON)
Insert load Z between B (earth ground, power cord plug prongs) and exposed accessible parts. Use an AC voltmeter to measure across both terminals of load Z. See figure and following table.

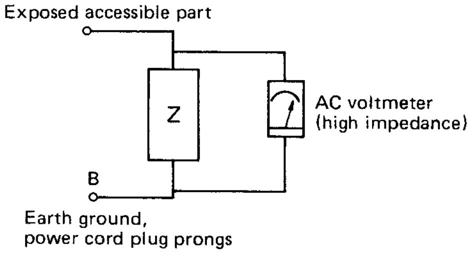


Fig. 9

AC Line Voltage	Region	Insulation Resistance	Dielectric Strength	Clearance Distance (d), (d')
100 V	Japan	≧ 1 mΩ/500 V DC	1 kV 1 minute	≧ 3 mm
110 to 130 V	USA & Canada	—	900 V 1 minute	≧ 3.2 mm
*110 to 130 V 200 to 240 V	Europe Australia	≧ 10 mΩ/500 V DC	4 kV 1 minute	≧ 6 mm (d) ≧ 8 mm (d') (a: Power cord)

*Class II model only.

Table 1 Ratings for selected areas

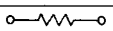
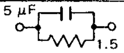
AC Line Voltage	Region	Load Z	Leakage Current (i)	Earth Ground (b) to:
100 V	Japan	 1 kΩ	i ≦ 1 mA rms	Exposed accessible parts
110 to 130 V	USA & Canada	 0.15 μF 1.5 kΩ	i ≦ 0.5 mA rms	Exposed accessible parts
110 to 130 V 220 to 240 V	Europe Australia	2 kΩ	i ≦ 0.7 mA peak i ≦ 2 mA dc	Antenna earth terminals
		50 kΩ	i ≦ 0.7 mA peak i ≦ 2 mA dc	Other terminals

Table 2 Leakage current ratings for selected areas

Note: This table is unofficial and for reference only. Be sure to confirm the precise values for your particular country and locality.

SECTION 1
GENERAL DESCRIPTION

1-1 INTRODUCTION

This manual provides service information for the JVC VHS Models HR-3300EG and HR-3300EK. The manual describes the principles and adjustments of mechanical electrical operations for this model.
Service procedures given herein cover only field maintenance service. Adjustments which require high-level instruments, jigs and techniques are excluded, since they should be performed at the factory.

Due to design modifications, the servicing procedures and data given in this manual are subject to possible change without prior notice.

VHS

Only cassettes marked VHS can be used with this video cassette recorder.

1-2 WARNING FOR HR-3300EG

WARNING:
TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

POWER SYSTEM

Connection to the mains supply

The operating voltage of this video cassette recorder is preset to 220 V∿ at the factory.
Before connecting to mains, check that the voltage selector on the rear panel is set to the same voltage as your local mains supply.

Adapting to local power line

The video cassette recorder operates on either 110, 127, 220 or 240 V∿. The voltage selector can be reset as follows.
Turn the fuse holder and remove the holder. Pull out the voltage selector plug and reinsert it so that the proper voltage appears at the cutout.
If any doubt exists regarding this setting, consult your JVC dealer.

IMPORTANT: It is permissible to record television programmes only in the event that third party copyrights and other rights are not violated.

POWER SWITCH

The mains switch is located on the rear connector panel. Setting this switch to OFF removes all applied power from the set including the timer clock. Switching on and off the VCR section is performed with the front panel operation switch having three positions; TIMER/SLEEP, OPERATE and STAND BY.

1-3 WARNING FOR HR-3300EK

IMPORTANT (In the United Kingdom)
Mains Supply (AC 240 V∿, 50 Hz only)

IMPORTANT

Do not make any connection to the Larger Terminal coded E or Green. The wires in the mains lead are coloured in accordance with following code:

Blue to N (Neutral) or Black
Brown to L (Live) or Red

If these colours do not correspond with the terminal identifications of your plug, connect as follows:
Blue wire to terminal coded N (Neutral) or coloured Black. Brown wire to terminal coded L (Live) or coloured Red.
If in doubt– consult a competent electrician.

Note:

We recommend that you should disconnect the AC cord from the outlet.

WARNING:
TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

POWER SYSTEM

Connection to the mains supply

The operating voltage of this video cassette recorder is preset to 240 V∿ at the factory.
Before connecting to mains, check that the voltage selector on the rear panel is set to the same voltage as your local mains supply.

Adapting to local power line

The video cassette recorder operates on either 110,

127, 220 or 240 V ∿. The voltage selector can be reset as follows.
Turn the fuse holder and remove the holder. Pull out the voltage selector plug and reinsert it so that the proper voltage appears at the cutout.
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1-4 FEATURES

- Recording and playback for long periods (180 min.) are possible. Operation is very easy.
- Crisp, clean pictures. AGC system assures continuous, high-quality recording and playback.
- Compact and light weight.
- Programmes, even though not being viewed, can be recorded.
- Timer recording is possible using the built-in timer.
- Audio dubbing is possible.
- Sleep timer facility is included.
- Low power consumption of 28 watts. (35 watts when using automatic heating is activated.)
- Those tapes recorded on PAL-standard VHS recorders are totally interchangeable between different VHS recorders.

1-5 SPECIFICATIONS FOR HR-3300EG

Format		: VHS PAL standard
Video recording system		: Rotary, slant azimuth two-head helical scan system
Video signal system		: PAL colour (system G) & CCIR monochrome signals, 625 lines
Tape width		: 12.7 mm
Tape speed		: 23.39 mm/sec
Recording time		: 180 min. (JVC E-180 cassette)
Power requirement		: 110/127/220/240 V AC selectable (to be adjusted by your dealer), 50 Hz, 35 watts (including Video timer)
Temperature	Operating	: 5°C to 40°C
	Storage	: –20°C to 60°C
Aerial input		: VHF Band I, channels 2–4; VHF Band III, channels 5–12; UHF Band IV/V, channels 21 – 69
Aerial output		: UHF channels 43–47 (Adjustable)
Video signals		
Input		: 0.5 to 2.0 Vp-p/75 ohms
Output		: 1.0 Vp-p/75 ohms
S/N ratio		: 40 dB
Horizontal resolution		: Colour More than 240 lines Monochrome More than 290 lines
Audio signals		
Input		: Mic –67 dBs/10 kohms Line –20 dBs/50 kohms
Output		: Line 0 dBs/1 kohm
S/N ratio		: More than 40 dB
Frequency response		: 70 Hz – 8 kHz
Video timer		
Type		: 24-hour LED digital indication
Timer accuracy		: Excellent, locked to power line frequency
Dimensions		: 453 mm(W) x 147 mm(H) x 314 mm(D)
Weight		: 13.9 kg
Accessories provided		: Power cord : QMP3950-183 Video cassette : E-30 Dust cover : PU44884-3 Aerial cable : PU43294B

1-6 SPECIFICATIONS FOR HR-3300EK

Format		: VHS PAL standard
Video recording system		: Rotary, slant azimuth two-head helical scan system
Video signal system		: PAL colour (system I) & CCIR monochrome signals, 625 lines
Tape width		: 12.7 mm
Tape speed		: 23.39 mm/sec
Recording time		: 180 min. (JVC E-180 cassette)
Power requirement		: 110/127/220/240 V AC selectable (to be adjusted by your dealer), 50 Hz, 35 watts (including Video Timer)
Temperature	Operating	: 5°C to 40°C
	Storage	: –20°C to 60°C
Aerial input		: UHF Band IV/V, channels 21 –69
Aerial output		: UHF channels 43–47 (Adjustable)

Video signals	
Input	: 0.5 to 2.0 Vp-p/75 ohms
Output	: 1.0 Vp-p/75 ohms
S/N ratio	: 40 dB
Horizontal resolution	: Colour; More than 240 lines Monochrome; More than 290 lines
Audio signals	
Input	: Mic −67 dBs/10 k ohms Line −20 dBs/50 k ohms
Output	: Line 0 dBs/1 k ohm
S/N ratio	: More than 40 dB
Frequency response	: 70 Hz – 8 kHz
Video timer	
Type	: 24-hour LED digital indication
Timer accuracy	: Excellent, locked to power line frequency
Dimensions	: 453 mm(W) x 147 mm(H) x 314 mm(D)
Weight	: 13.9 kg
Accessories provided	: Power cord : PU46128 Video cassette : E-30 Dust cover : PU44884-3 Aerial cable : PU43294A

1-7 PRECAUTIONS

Handling and storage

- Avoid using the HR-3300E under the following conditions:
  - extremely hot, cold or humid places,
  - dusty places,
  - near appliances generating strong magnetic fields,
  - places subject to vibration, and
  - poorly ventilated places.
- Be careful of moisture condensation.
  Avoid using the HR-3300E immediately after moving from a cold place to a warm place or soon after heating a room which was cold, the water vapor in warm air will condense on the still-cold video head drum and tape guides and may cause damage to the tape and the recorder.
- Handle the HR-3300E carefully.
  - Do not block the ventilation openings.
  - Do not place anything heavy on the recorder.
  - Do not place anything which might spill and cause trouble on the top cover of the recorder.
  - Utilize the accessory cover to prevent dust and dirt from accumulating on the recorder.
  - Use in horizontal (flat) position only.
- In case of transportation,
  - Avoid violent shocks to the recorder during packing and transportation.
  - Before packing, be sure to remove the cassette from the recorder.

Video cassettes

- The HR-3300E employs VHS type cassettes only. E-180 for 180 minutes, E-120 for 120 minutes, E-60 for 60 minutes and E-30 for 30 minutes of recording.
- Video cassettes are equipped with a safety tab to prevent accidental erasure. When the tab is removed, recording cannot be performed. If you wish to record on a cassette whose tab has already been removed, use adhesive tape to block the slot.
- Avoid exposing the cassettes to direct sunlight. Keep them away from heaters.
- Avoid extreme humidity, violent vibrations or shocks, strong magnetic fields (near a motor, transformer or a magnet) and dusty places.
- Place the cassettes in cassette cases and position vertically.

Moisture condensation

- If you pour a cold liquid into a glass, water vapor in the air will condense on the surface of the glass. This is called moisture condensation.
- Moisture condensation on the head drum, one of the most crucial parts of the HR-3300E, will cause damage to the tape.
- Moisture in the air will condense on the HR-3300E when you move the unit from a cold place to a warm place, after heating a cold room or under extremely humid conditions.
- Should the PLAY key return to its previous position by itself right after being depressed, the cause may be moisture condensation. If such is the case, repeat the FF and REW operations.
- The HR-3300E is equipped with a moisture condensation prevention circuit. This circuit operates only when the rear panel POWER switch is turned ON.

1-8 CONTROLS AND CONNECTORS FOR HR-3300EG

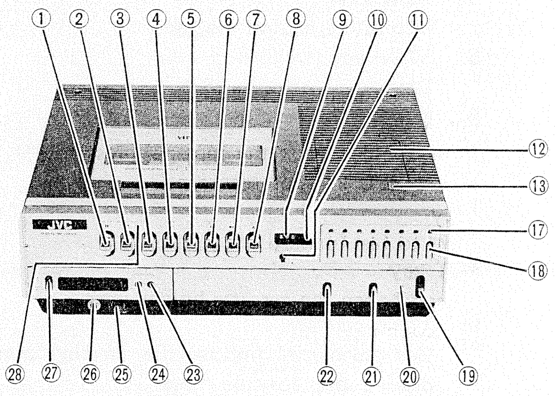
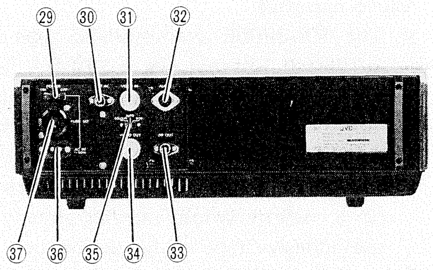


Fig. 1-1



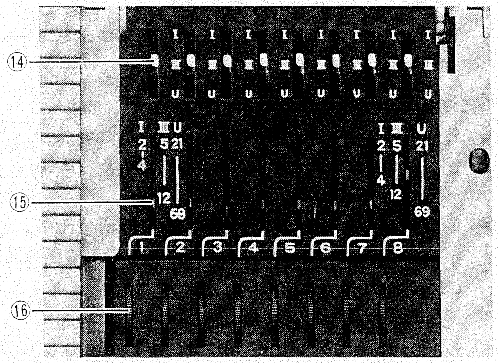


Fig. 1-3

1. **PAUSE key**
   Depress to stop the tape temporarily during recording or playback.
2. **AUDIO DUB key**
   Depress together with the PLAY key to record sounds on a pre-recorded tape.
3. **REC key**
   Depress together with the PLAY key for video and audio recording. (Sounds are also recorded simultaneously.) Depress only the REC key to monitor signals which you are going to record.
4. **REW key**
   Depress to rewind the tape.
5. **STOP key**
   Depress to stop the tape.
6. **PLAY key**
   Depress to play back the tape. Depress together with the REC key for recording.
7. **FF key**
   Depress to fast-forward the tape.
8. **EJECT key**
   Depress to open the cassette holder.
9. **TAPE counter**
   Convenient in finding the starting point of a desired part of the tape.
10. **Counter reset button**
    Depress to reset the counter to "000".
11. **SEARCH button**
    With this button depressed, the tape stops automatically when the counter reaches "999" during rewinding.
12. **Pre-tuning control compartment cover**
    Opening the cover makes accessible the built-in electronic tuner pre-tuning controls.
13. **Compartment cover release tab**
    Press to open the cover. See pages 7 and 9.
14. **VHF/UHF band selectors**
    A three-position switch for selecting the VHF low channels (channel 2 to 4), VHF high channels (channel 5 to 12) and UHF channels (channel 21 – 69) is provided for 8 separate channels.
15. **Pre-tuning indicators**
    Indicate the channel to which each programme selector is tuned.
16. **Pre-tuning controls**
    Turn in either direction to tune in 8 different television stations.
17. **Programme indicator lamps**
    The green LED's indicate which programme you are recording.
18. **Pushbutton programme selectors**
    Press for reception from stations pre-tuned by means of the pre-tuning controls.
19. **STAND-BY switch**
    Set to OPERATE for switching on the recorder and to STAND BY when you are not using the recorder. Set to TIMER/SLEEP for recording while away or after you fall asleep.
20. **Indicator lamp**
    Lights when the operation switch is in the OPERATE position or when the recorder is in the record or playback mode with the operation switch set at TIMER/SLEEP.
21. **VIDEO/TV switch**
    Set to TV to view TV programmes. Set to VIDEO to view playback.
22. **REC SELECT switch**
    Set to TV for recording from the built-in tuner. Set to AUX for video recording from a camera or other sources.
23. **MIN (Minute) button**
    Pressing once advances the time indication by one minute. Employ for correct time and timer settings.
24. **HOUR button**
    Pressing once advances the time indication by one hour. Employ for correct time and timer settings.
25. **TRACKING control**
    Permits picture adjustment during playback.
26. **MIC jack**
    Connect a microphone for audio dubbing.
27. **SELECT switch**
    Hold up to the TIMER SET position to set the

switch-on time. Hold down to the TIME ADJ position to adjust to the correct time.

28. **Recording indicator lamp**
Lights when the REC key is depressed.

29. **POWER switch**
Switching ON applies mains power to the set. To switch off the set completely, set the POWER switch to OFF. This also switches off the timer clock.

30. **ANTENNA connector**
Connect an external antenna to this connector.

31. **VIDEO IN terminal**
Connect a video camera.

32. **AUDIO input/output DIN socket**
Connect a tape recorder or other audio sources or connect the audio output line of a video camera.

33. **RF OUT connector**
Connect to the antenna connector of a TV receiver through the aerial cable provided.

34. **VIDEO OUT terminal**
Video signals being recorded or played back are available from this terminal.

35. **Video mode switch**
This is effective both for recording and playback.
AUTO : The circuit is automatically switched for colour or black/white mode. This position is sufficient for most purposes.
COLOUR : Set to this position when the input or playback video signal is in colour.
B/W : Set to this position when the input or playback signal is monochrome.

36. **AC IN socket**
Connect the AC power cord (provided) to this socket.

37. **Fuse holder/Voltage selector**
Use a 1 AT fuse. To reset the operating voltage, first remove the fuse and reinsert the voltage selector plug to its proper setting.

1-9 CONTROLS AND CONNECTORS FOR HR-3300EK

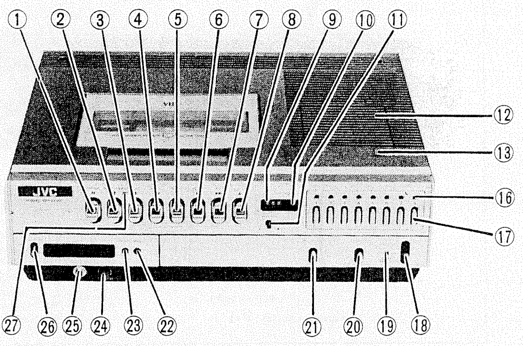
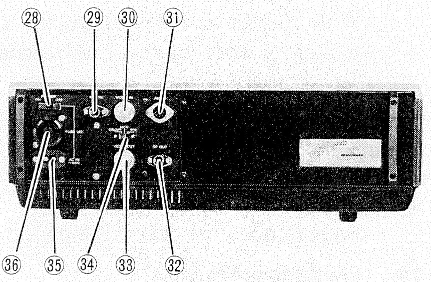


Fig. 1-4



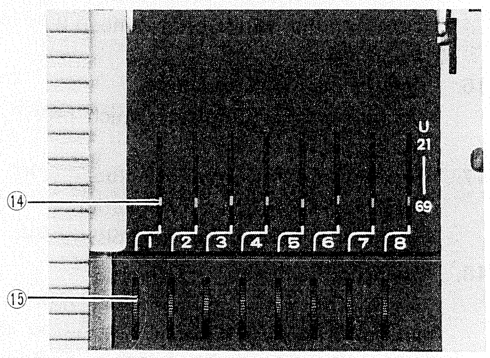


Fig. 1-6

1. **PAUSE key**
Depress to stop the tape temporarily during recording or playback.

2. **AUDIO DUB key**
Depress together with the PLAY key to record sounds on a pre-recorded tape.

3. **REC key**
Depress together with the PLAY key for video and audio recording. (Sounds are also recorded simultaneously.) Depress only the REC key to monitor signals which you are going to record.

4. **REW key**
Depress to rewind the tape.

5. **STOP key**
Depress to stop the tape.

6. **PLAY key**
Depress to play back the tape. Depress together with the REC key for recording.

7. **FF key**
Depress to fast-forward the tape.

8. **EJECT key**
Depress to open the cassette holder.

9. **TAPE counter**
Convenient in finding the starting point of a desired part of the tape.

10. **Counter reset button**
Depress to reset the counter to "000".

11. **SEARCH button**
With this button depressed, the tape stops automatically when the counter reaches "999" during rewinding.

12. **Pre-tuning control compartment cover**
Opening the cover makes accessible the built-in electronic tuner pre-tuning controls.

13. **Compartment cover release tab**
Press to open the cover. See pages 7 and 9.

14. **Pre-tuning indicators**
Indicate the channel to which each programme selector is tuned.

15. **Pre-tuning controls**
Turn in either direction to tune in 8 different television stations.

16. **Programme indicator lamps**
The green LED's indicate which programme you are recording.

17. **Push button programme selectors**
Press for reception from stations pre-tuned by means of the pre-tuning controls.

18. **Operation switch**
Set to OPERATE for switching on the recorder and to STAND BY when you are not using the recorder. Set to TIMER/SLEEP for recording while away or after you fall asleep.

19. **Indicator lamp**
Lights when the operation switch is in the OPERATE position or when the recorder is in the record or playback mode with the operation switch set at TIMER/SLEEP.

20. **VIDEO/TV switch**
Set to TV for recording from the built-in tuner. Set to VIDEO to view playback.

21. **REC SELECT switch**
Set to TV for recording from the built-in tuner. Set to AUX for video recording from a camera or other sources.

22. **MIN (Minute) button**
Pressing once advances the time indication by one minute. Employ for correct time and timer settings.

23. **HOUR button**
Pressing once advances the time indication by one hour. Employ for correct time and timer settings.

24. **TRACKING control**
Permits picture adjustment during playback.

25. **MIC jack**
Connect a microphone for audio dubbing.

26. **SELECT switch**
Hold up to the TIMER SET position to set the switch-on time. Hold down to the TIME ADJ position to adjust to the correct time.

27. **Recording indicator lamp**
Lights when the REC key is depressed.

28. **POWER switch**
Switching ON applies mains power to the set. To switch off the set completely, set the POWER switch to OFF. This also switches off the timer clock.

29. **ANTENNA connector**
Connect an external antenna to this connector.

30. **VIDEO IN terminal**
Connect a video camera.

31. **AUDIO input/output DIN socket**
Connect a tape recorder or other audio sources or connect the audio output line of a video camera.

32. **RF OUT connector**
Connect to the antenna connector of a TV receiver through the aerial cable provided.

33. **VIDEO OUT terminal**
Video signals being recorded or played back are available from this terminal.

34. **Video mode switch**
This is effective both for recording and playback.
AUTO : The circuit is automatically switched for colour or black/white mode. This position is sufficient for most purposes.
COLOUR : Set to this position when the input or playback video signal is in colour.
B/W : Set to this position when the input or playback signal is monochrome.

35. **AC IN socket**
Connect the AC power cord (provided) to this socket.

36. **Fuse holder/Voltage selector**
Use a 1 AT fuse. To reset the operating voltage, first remove the fuse and reinsert the voltage selector plug to its proper setting.

1-10 CONNECTION DIAGRAM

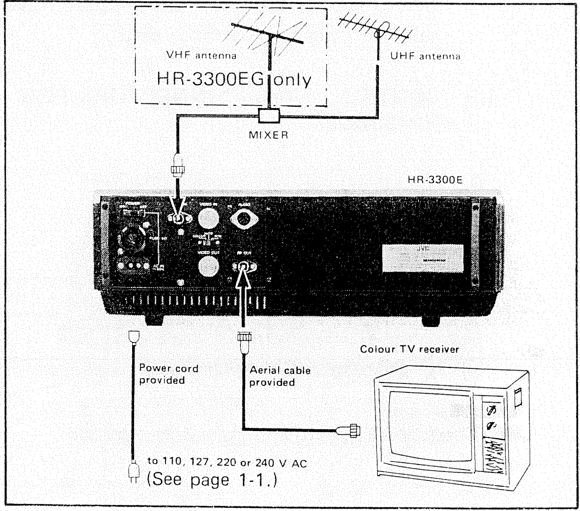


Fig. 1-7

Notes:

- Remove the VHF and UHF antenna cables from the TV receiver and reconnect to the HR-3300E as illustrated. The HR-3300E is then ready to record off-the-air programmes.
- Connect the HR-3300E to the TV receiver using the aerial cable (provided). The TV receiver is then ready to receive TV broadcast programmes as well as video cassette programmes from the HR-3300E.

In areas where broadcast signals are extremely weak, connecting the HR-3300E to the TV receiver may cause deterioration in picture quality. This is due to a single antenna being simultaneously employed for both the HR-3300E and TV receiver. In such cases, utilize a signal booster.

1-11 TIMER CLOCK SETTING

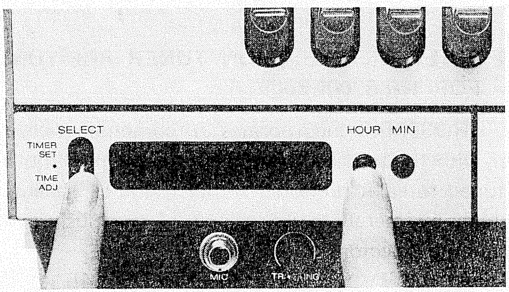


Fig. 1-8

When the HR-3300E is plugged into an AC outlet and the rear panel POWER switch is turned ON, the built-in timer clock starts time-keeping.

Setting to the correct time

1. Hold the SELECT switch down to the TIME ADJ position.
2. Press the HOUR and MIN buttons repeatedly until the correct time is displayed.
3. Clock operation starts when the SELECT switch is released.

- **For accurate time setting**

Advance the time indication to one minute ahead of the clock or telephone time recording. Wait for the time signal while holding the SELECT switch down. Release the SELECT switch at the exact instant of the time signal, and the timer will be set accurately to the correct time.

1-12 VIDEO CHANNEL SETTING

The built-in RF converter permits playback of video and audio recordings through a TV receiver. The signals from RF converter the are viewed through a vacant channel not used for broadcasting. The converter channel of all units is set to UHF channel 45 prior to shipment. If channel 45 is employed for broadcasting, the converter channel must be reset. Consult your JVC dealer for resetting the channel to one of the vacant channels between 43 and 47. Remember that channel number. This is YOUR video channel. To view video cassettes, always select this channel on the TV receiver.

1-13 BUILT-IN TELEVISION TUNER PRE-TUNING FOR HR-3300EG

The HR-3300EG incorporates a complete television tuner with the required tuning controls. Once you have pre-tuned to eight preferred stations, you can select one of them by merely pressing one of the push-button programme selectors.

1. Adjust the TV receiver channel to UHF 45 (or your video channel).
2. Set the STAND-BY switch to OPERATE. Now the indicator lamp lights.

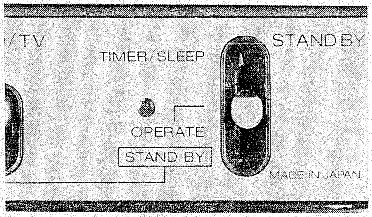


Fig. 1-9

3. Set the REC SELECT switch to TV and the VIDEO/TV switch to VIDEO.

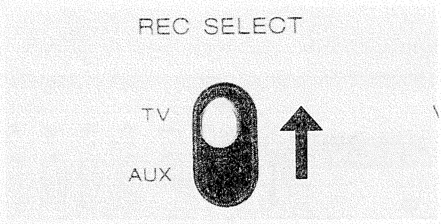


Fig. 1-10

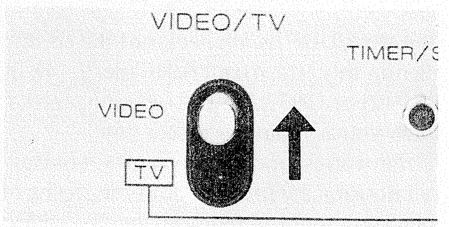


Fig. 1-11

4. Load a cassette and depress the REC key.

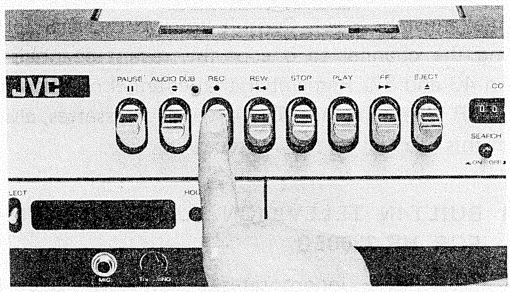

JVC
PAUSE
AUDIO DUB
REC
REW
STOP
PLAY
FF
EJECT
SEARCH
MIC

Fig. 1-12

5. Press the compartment cover release tab, and the cover will open slightly. Then lift up the cover completely.

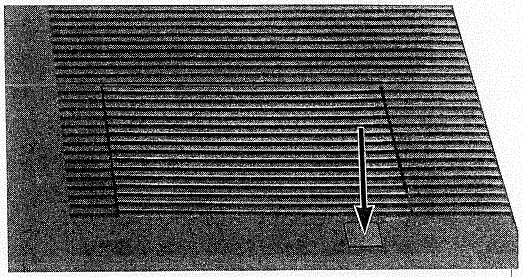


Fig. 1-13

6. Press one of the pushbutton programme selectors (for example 4).

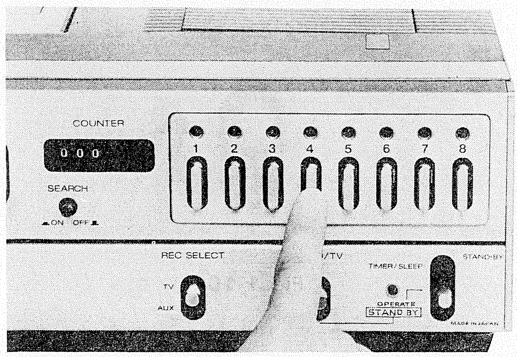

COUNTER
000
SEARCH
ON OFF
1
2
3
4
5
6
7
8
REC SELECT
TV
AUX
TIMER/SLEEP
OPERATE
STAND BY
STAND-BY

Fig. 1-14

7. Set the VHF/UHF band selector of the corresponding number (in this case, 4) to I (VHF low 2–4), III (VHF high 5–12) or UHF (21–69) according to the station to which you are going to tune.
8. Turn the corresponding pre-tuning control to the desired position, referring to both the tuning indicator and the monitored picture on the TV screen simultaneously.

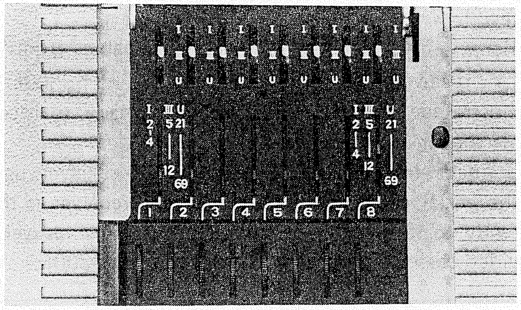

I III U
2 5 21
4
12
69
1
2
3
4
5
6
7
8

Fig. 1-15

9. Press the next push-button programme selector and adjust the corresponding pre-tuning control in the same way. Proceed in the same manner for the remaining channels as required.
10. Close the compartment cover. Closing it will activate the AFT (Automatic Fine Tuning) function which provides optimum tuning.

1-14 BUILT-IN TELEVISION TUNER PRE-TUNING FOR HR-3300EK

The HR-3300EK incorporates a complete television tuner with the required tuning controls. Once you have pre-tuned to eight preferred stations, you can select one of them by merely pressing one of the push button programme selectors.

1. Adjust the TV receiver channel to UHF 45 (or your video channel).
2. Set the operation switch to OPERATE. Now the indicator lamp lights.

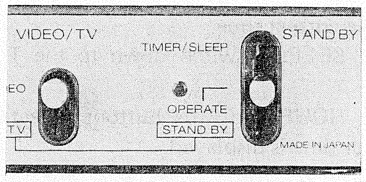

VIDEO/TV
TIMER/SLEEP
STAND BY
EO
TV
OPERATE
STAND BY
MADE IN JAPAN

Fig. 1-16

3. Set the REC SELECT switch to TV and the VIDEO/TV switch to VIDEO.

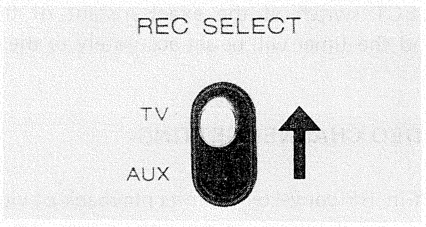

REC SELECT
TV
AUX

Fig. 1-17

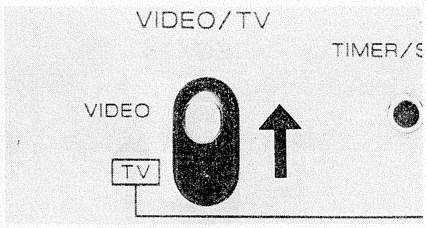

VIDEO/TV
TIMER/S
VIDEO
TV

Fig. 1-18

4. Load a cassette and depress the REC key.

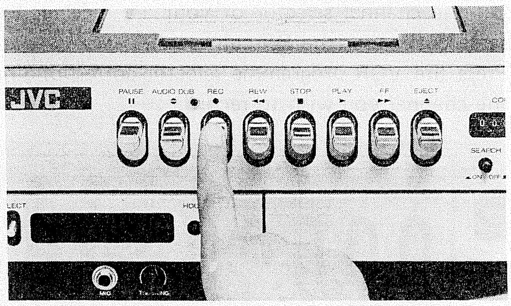

JVC
PAUSE
AUDIO DUB
REC
REW
STOP
PLAY
FF
EJECT
SEARCH

Fig. 1-19

5. Press the compartment cover release tab, and the cover will open slightly. Then lift up the cover completely.

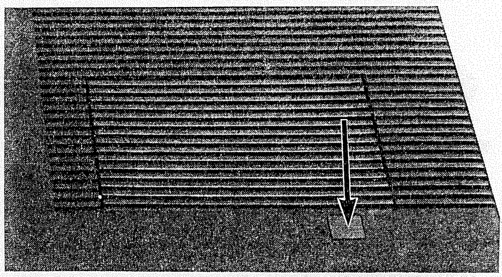


Fig. 1-20

6. Press one of the push button programme selectors (for example 4).

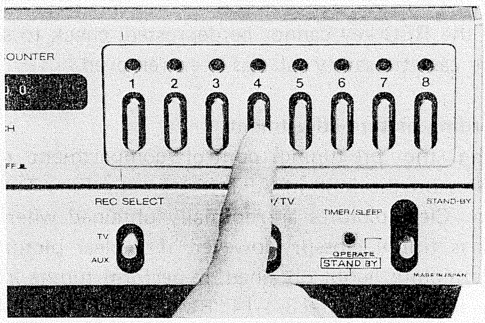

COUNTER
1
2
3
4
5
6
7
8
REC SELECT
TV
AUX
/TV
TIMER/SLEEP
OPERATE
STAND BY
STAND-BY
MADE IN JAPAN

Fig. 1-21

7. Turn the corresponding pre-tuning control to the desired position, referring to both the tuning indicator and the monitored picture on the TV screen simultaneously.

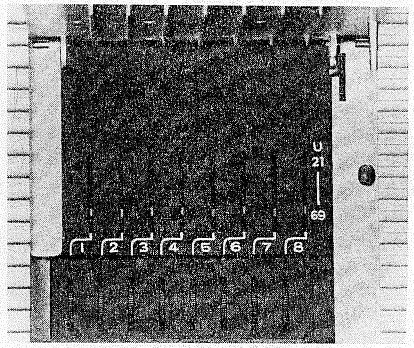

U
21
69
1
2
3
4
5
6
7
8

Fig. 1-22

8. Press the next push button programme selector and adjust the corresponding pre-tuning control in the same way. Proceed in the same manner for the remaining channels as required.
9. Close the compartment cover. Closing it will activate the AFT (Automatic Fine Tuning) function which provides optimum tuning.

1-15 LOADING AND UNLOADING THE VIDEO CASSETTE

Loading

1. Depress the EJECT key. The cassette holder will pop up.
2. Load the cassette in the proper manner as shown.
3. Press the holder down to lock-in the cassette.

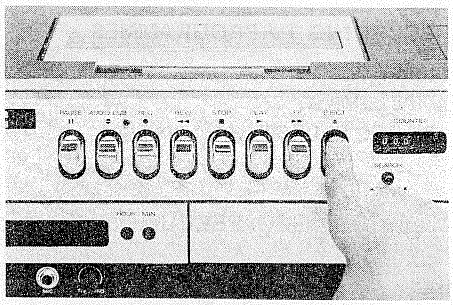

PAUSE
AUDIO DUB
REC
REW
STOP
PLAY
FF
EJECT
COUNTER
SEARCH
HOUR
MIN

Fig. 1-23

Notes:

- An inverted cassette cannot be inserted.
- Be sure the cassette is fully inserted into the holder before pressing down.

Unloading

1. Depress the EJECT key after making certain that the HR-3300E is in the STOP mode. The cassette holder will pop up.
2. Remove the cassette.
3. Press down on the holder.

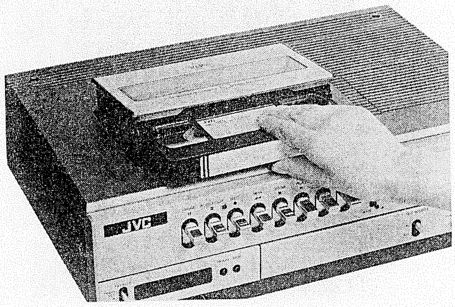


Fig. 1-24

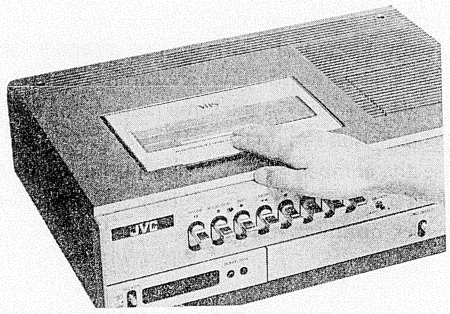


Fig. 1-25

Note:

- First make certain that the HR-3300E is not in operation. If in operation, depress the STOP key and wait until the tape is completely unthreaded.

1-16 RECORDING TV PROGRAMMES

Preparation

1. Load the cassette.
2. Set the REC SELECT switch to TV.

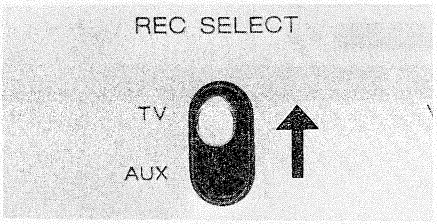


Fig. 1-26

3. Set the VIDEO/TV switch to VIDEO.

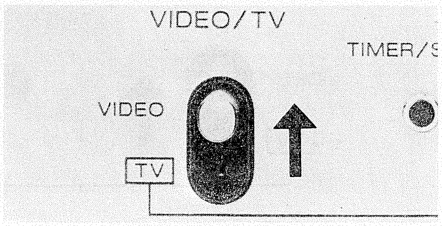


Fig. 1-27

4. Set the channel selector of your TV receiver to the same channel as the RF converter.
5. Press the VCR programme selector corresponding to the channel you wish to record.

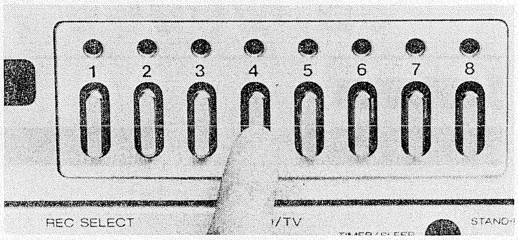


Fig. 1-28

6. Depress the REC key. The pictures will appear on the TV screen, but recording is not yet taking place.

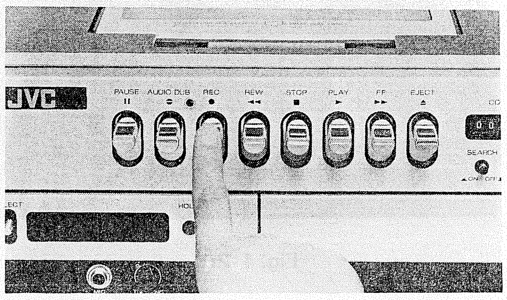


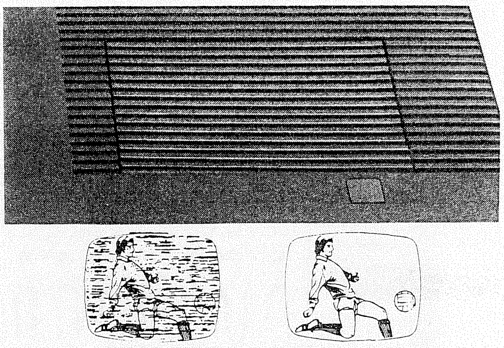
Fig. 1-29

Note:

- If the REC key cannot be depressed, check to see if the cassette safety tab has been removed.

Recording picture adjustment

Closing the pre-tuning control compartment cover switches on the built-in AFT (Automatic Fine Tuning) circuit. Clear pictures are normally obtained when the cover is firmly closed. However, if a clear picture or correct colour is not obtained, re-perform tuning in the manner described in 1-13, 1-14 "BUILT-IN TELEVISION TUNER PRE-TUNING".



Snowy picture No colour

Fig. 1-30

Notes:

- If the picture is still not clear, perform the fine tuning adjustment on the TV receiver.
- Distorted pictures or sound will be recorded if fine tuning has not been properly performed. Exercise care with this adjustment since the recorded picture and sound cannot be adjusted later.

Recording

1. Depress the REC and PLAY keys simultaneously. Recording will start.

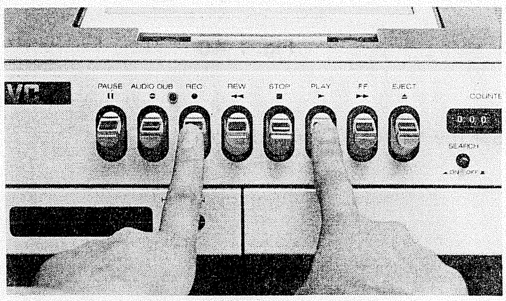

PAUSE
AUDIO DUB
REC
REW
STOP
PLAY
FF
EJECT
SEARCH

Fig. 1-31

2. To skip recording of part of the programme, depress the PAUSE key. The tape will stop while in the REC mode. Depress again to restart recording.

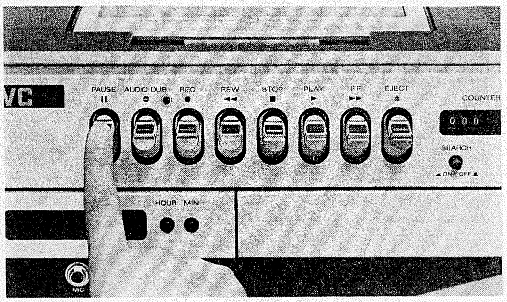

PAUSE
AUDIO DUB
REC
REW
STOP
PLAY
FF
EJECT
COUNTER
SEARCH
HOUR
MIN
MIC

Fig. 1-32

3. To stop recording, depress the STOP key.

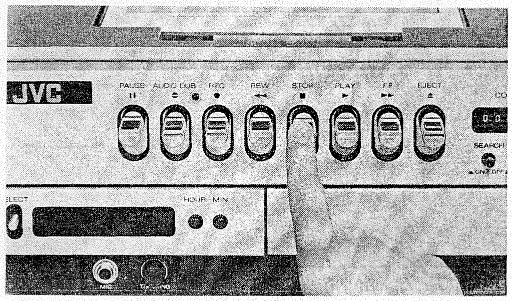

JVC
PAUSE
AUDIO DUB
REC
REW
STOP
PLAY
FF
EJECT
SEARCH
HOUR
MIN
MIC

Fig. 1-33

Note:

- Sound from a microphone connected to the MIC jack can be mixed with the TV sound being recorded.

1-17 PLAYBACK

1. Load the cassette.
2. Set the VIDEO/TV switch to VIDEO.

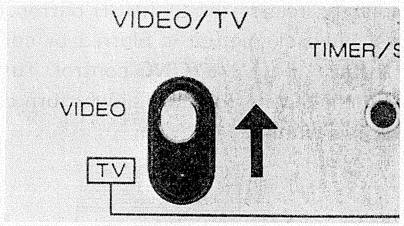

VIDEO/TV
TIMER/
VIDEO
TV

Fig. 1-34

3. Set the TV channel selector to the same channel as the RF converter (your video channel).
4. Depress the REW key to rewind the tape, if necessary.

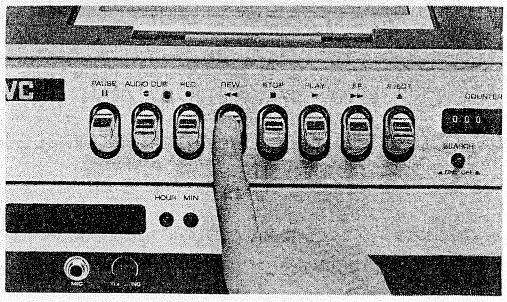

PAUSE
AUDIO DUB
REC
REW
STOP
PLAY
FF
EJECT
COUNTER
SEARCH
HOUR
MIN
MIC

Fig. 1-35

5. Depress the PLAY key to start playback.

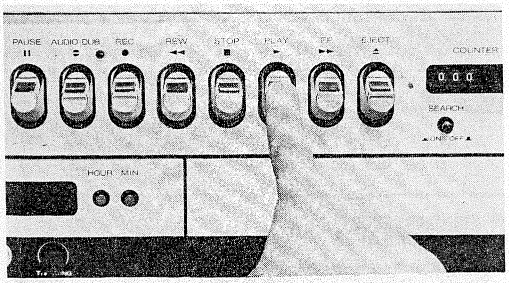

PAUSE
AUDIO DUB
REC
REW
STOP
PLAY
FF
EJECT
COUNTER
0 0 0
SEARCH
ON OFF
HOUR MIN

Fig. 1-36

6. Depress the STOP key to stop playback.

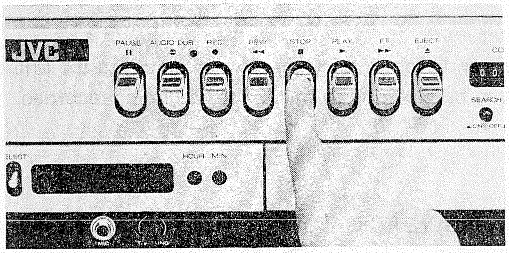

JVC
PAUSE
AUDIO DUB
REC
REW
STOP
PLAY
FF
EJECT
SEARCH
HOUR MIN

Fig. 1-37

Notes:

- If the SEARCH button is depressed, tape rewinding may stop before completion. If you wish to rewind completely, release the SEARCH button.
- If the playback picture is blurred or contains noise bars, adjust the TRACKING control. Turn the knob until a click is heard, then slowly turn clockwise to adjust the picture.

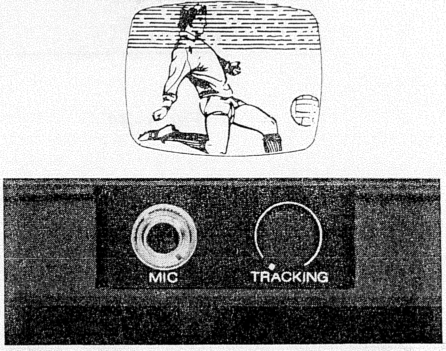

MIC
TRACKING

Fig. 1-38

1-18 RECORDING ONE PROGRAMME WHILE WATCHING ANOTHER

A programme not being viewed can be recorded while you enjoy viewing another programme.
This permits the recorded programme to be played back later at your convenience.

1. Load the cassette.
2. Press the HR-3300E programme selector corresponding to the channel you wish to record.

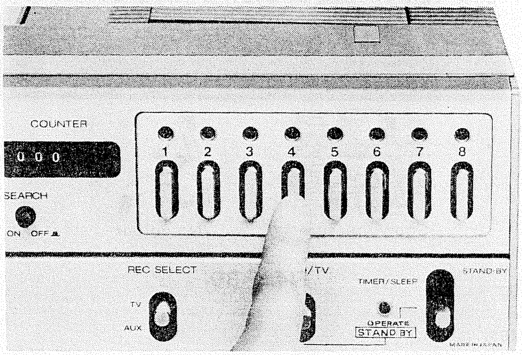

COUNTER
0 0 0
SEARCH
ON OFF
1
2
3
4
5
6
7
8
REC SELECT
TV
AUX
TIMER/SLEEP
OPERATE
STAND BY
STAND-BY

Fig. 1-39

3. Set the REC SELECT switch to TV.

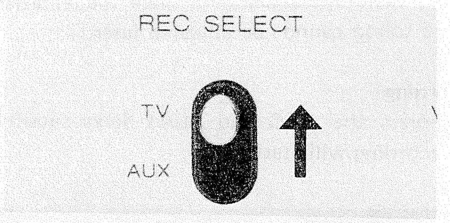

REC SELECT
TV
AUX

Fig. 1-40

4. Set the VIDEO/TV switch to TV.

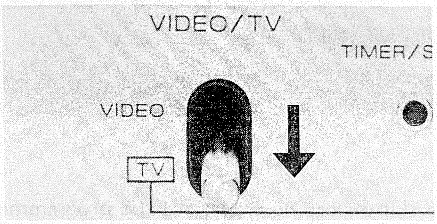

VIDEO/TV
TIMER/S
VIDEO
TV

Fig. 1-41

5. Depress the REC and PLAY keys simultaneously.

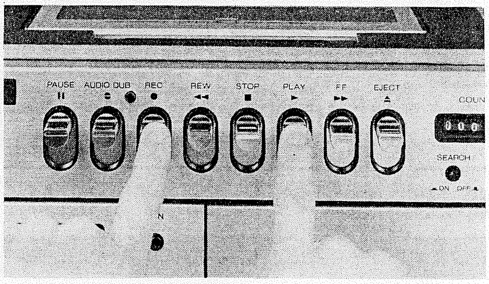

PAUSE
AUDIO DUB
REC
REW
STOP
PLAY
FF
EJECT
SEARCH
ON OFF

Fig. 1-42

6. Set the TV channel selector to the channel you wish to view.

Notes:

If a microphone is left plugged into the MIC jack, sound through the microphone is recorded at the same time.

If the VIDEO/TV switch is set to VIDEO, the TV picture becomes "snowy".

1-19 RECORDING DURING YOUR ABSENCE

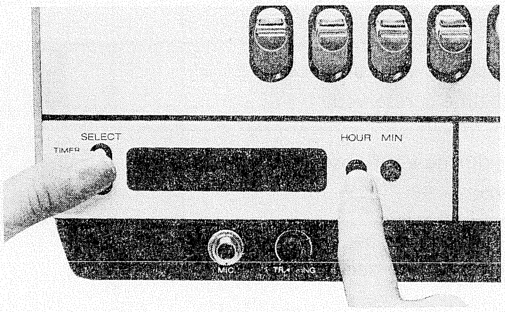

SELECT
TIMER
HOUR
MIN
MIC

Fig. 1-43

The built-in timer permits video cassette recording of off-the-air programmes while you are away, at any time during a 24-hour period.

Setting the timer to the time you wish recording to start

1. Hold the SELECT switch up to the TIMER SET position.
2. Press the HOUR and MIN buttons repeatedly until the desired switch-on time is displayed.
3. When the SELECT switch is released, the hour/minute dial indicates the present time and the desired switch-on time is "memorized".

Setting the HR-3300E for automatic timer recording

1. Load the cassette.
2. Set the REC SELECT switch to TV.

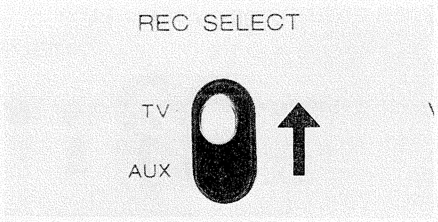

REC SELECT
TV
AUX

Fig. 1-44

3. Press the VCR programme selector corresponding to the channel you wish to record.

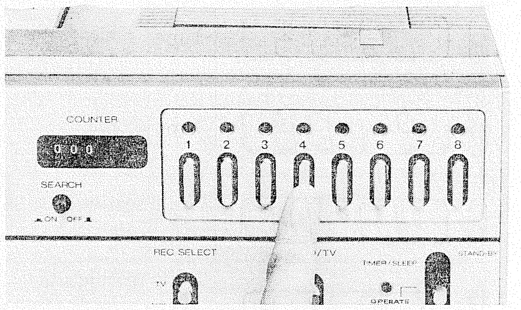

COUNTER
SEARCH
1
2
3
4
5
6
7
8
REC SELECT
OPERATE

Fig. 1-45

4. Set the STAND-BY switch to TIMER/SLEEP.

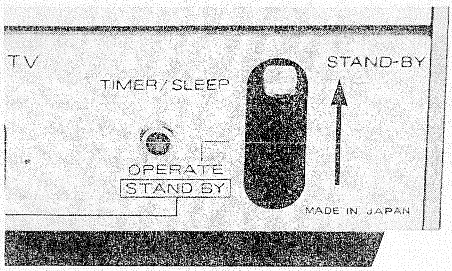

TV
TIMER/SLEEP
STAND-BY
OPERATE
STAND BY
MADE IN JAPAN

Fig. 1-46

5. Depress the REC and PLAY keys simultaneously.

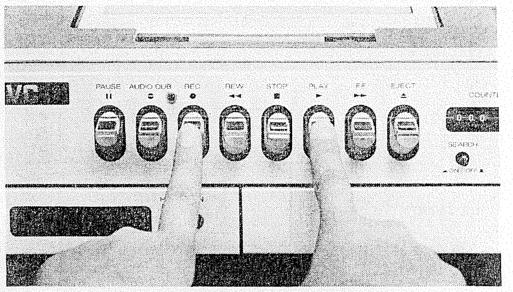
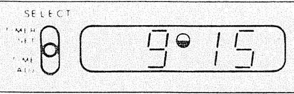
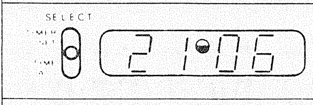
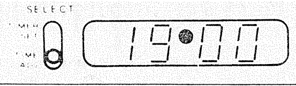
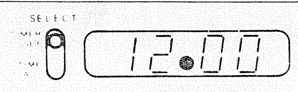
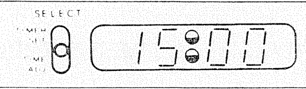
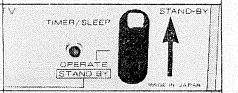
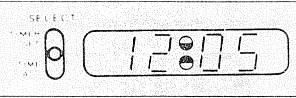
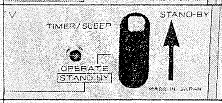
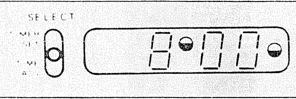

PAUSE
AUDIO DUB
REC
REW
STOP
PLAY
FF
EJECT

Fig. 1-47

Notes:

- Return the operation switch to STAND-BY when you return home.
- Be careful about the 24-hour AM/PM time indication. Before setting the switch-on time, make sure that the hour/minute dial indicates the correct time.

Timer indication	Mode	Function	Operation switch
	Time	It is 9:15 AM.	
	Time	It is 9:06 PM.	
	While setting the time.	The SELECT switch is held down. Adjust to the correct time.	
	While setting the time you wish to start recording.	The SELECT switch is held up. (To start recording from 12:00, set to 12:00.)	
	Switch on time is pre-set.	Recording during your absence at the pre-set time is reserved.	 TIMER/SLEEP OPERATE STAND BY STAND-BY
	During recording while absent.	Recording during your absence is taking place.	 TIMER/SLEEP OPERATE STAND BY STAND-BY
	Power failure indication.	When a power failure occurs.	

◒ . . . . . Flickers ● . . . . . Lights ◒◒ . . . . . Flicker simultaneously ◒◓ . . . . . Flicker alternatively

1-20 RECORDING WITH A COLOUR VIDEO CAMERA

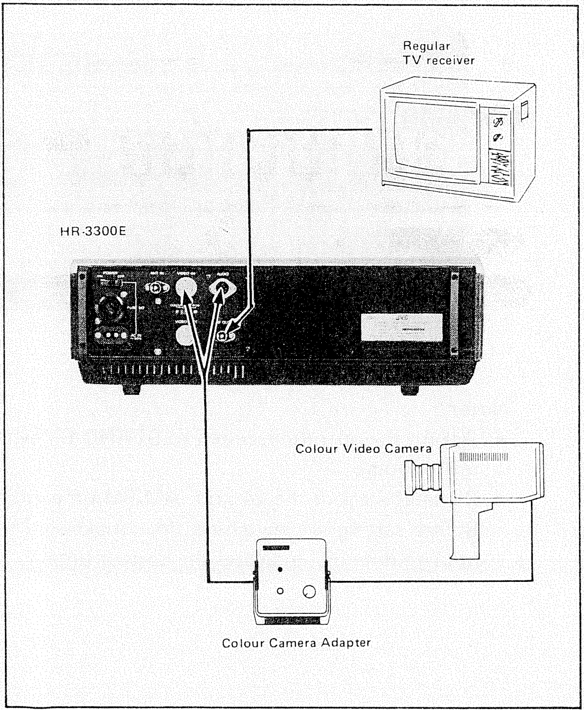

Regular
TV receiver
HR-3300E
Colour Video Camera
Colour Camera Adapter

Fig. 1-48

Operation

1. Turn on the HR-3300E, camera and TV receiver power switches and load the cassette to be recorded.
2. Set the TV channel selector to your video channel.
3. Set the REC SELECT switch to AUX.

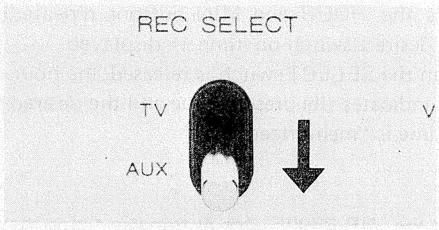

REC SELECT
TV
AUX

Fig. 1-49

4. Set the VIDEO/TV switch to VIDEO.

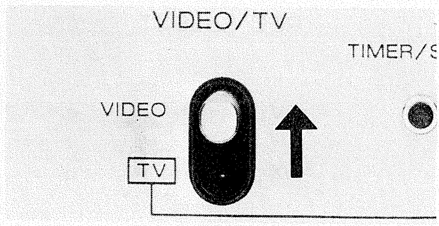

VIDEO/TV
TIMER/S
VIDEO
TV

Fig. 1-50

5. Depress the REC key. When this key is depressed, camera picture quality can be checked on the TV screen without recording.

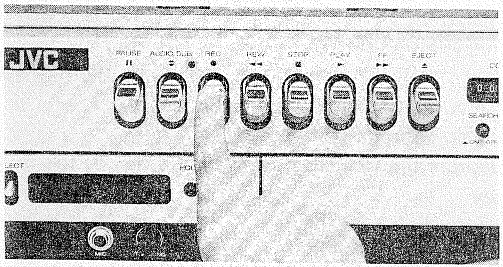

JVC
PAUSE
AUDIO DUB
REC
REW
STOP
PLAY
FF
EJECT
SEARCH

Fig. 1-51

6. Depress the REC and PLAY keys simultaneously to start recording.

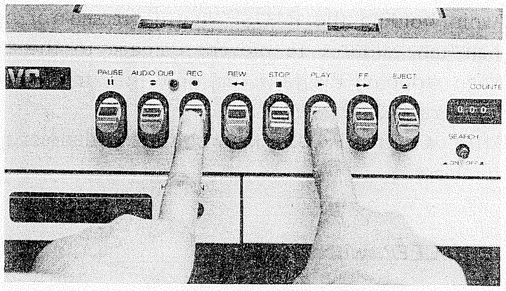

PAUSE
AUDIO DUB
REC
REW
STOP
PLAY
FF
EJECT
COUNTER
SEARCH

Fig. 1-52

Note:

- If feedback noise (whistling or howling) is heard from the TV receiver, reduce the volume or move the microphone, external or built-in the camera, farther away from the TV receiver.

1-21 AUDIO DUBBING

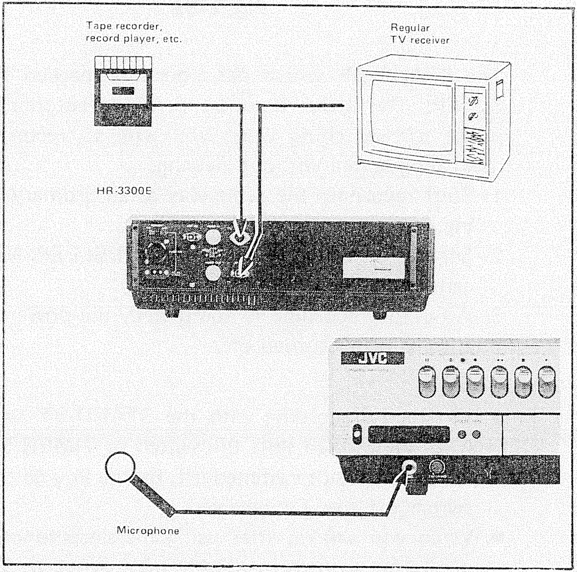

Tape recorder, record player, etc.
Regular TV receiver
HR-3300E
JVC
Microphone

Fig. 1-53

Audio dubbing means recording a sound track on a pre-recorded cassette. Sound from a source connected to the rear panel AUDIO jack, or from a microphone connected to the front panel MIC jack, or a mixture of the two can be recorded.

1. Load the pre-recorded tape, and set the TV channel selector to the video channel to monitor the playback picture.
2. Set the VIDEO/TV switch to VIDEO.

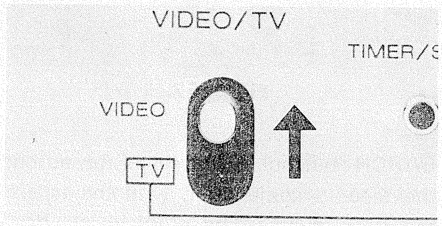

VIDEO/TV
TIMER/S
VIDEO
TV

Fig. 1-54

3. Set the REC SELECT switch to AUX.

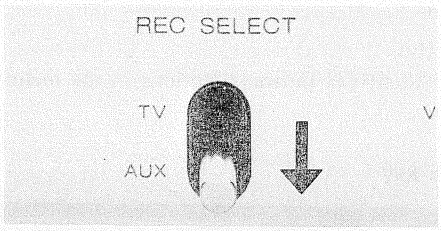

REC SELECT
TV
AUX
V

Fig. 1-55

4. Depress the AUDIO DUB and PLAY keys simultaneously.

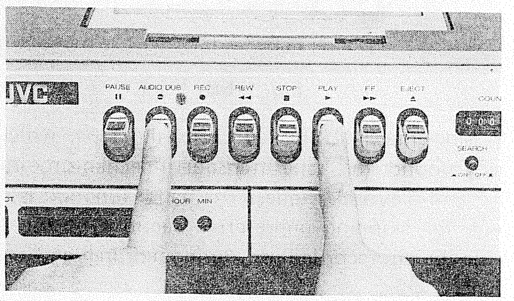

JVC
PAUSE
AUDIO DUB
REC
REW
STOP
PLAY
FF
EJECT
SEARCH
HOUR
MIN

Fig. 1-56

Notes:

- Use a high impedance microphone.
- If sound is recorded along with the picture on the pre-recorded tape, it can be replaced with a new sound track by audio dubbing.
- If a whistling or howling noise is heard during audio dubbing, reduce the TV volume or move the microphone farther away. Recording is being performed even if sound is not heard from the TV receiver.

1-22 CONVENIENT FACILITIES

SEARCH button

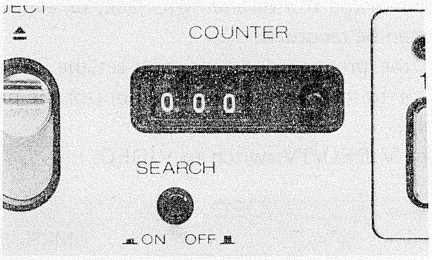


Fig. 1-57

The SEARCH button is employed to automatically index the tape in conjunction with the tape counter.

1. At the start of recording or playback, depress the counter reset button to reset the counter to "000".
2. Depress the SEARCH button to turn ON. With the SEARCH button depressed, the tape stops automatically when the counter reaches "999" in the rewind mode.

Note:

- The SEARCH button functions in the rewind mode only.

PAUSE key

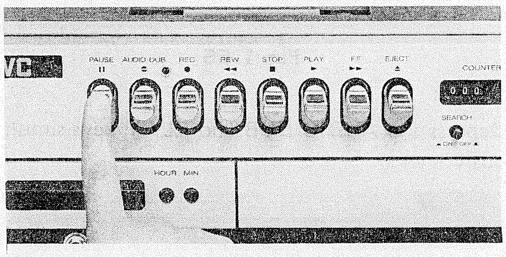


Fig. 1-58

Depressing the PAUSE key stops the tape, which is loaded around the tape transport mechanism, in the record and playback modes. The pause function is convenient for skipping unpreferred sections of the programme being recorded or during editing and audio dubbing.

During recording:

1. Depress the PAUSE key to temporarily stop the tape and avoid recording unpreferred parts of a programme.
2. Re-depress to continue recording.

During editing (recording a programme on a part of the pre-recorded tape):

1. Play back the tape and locate the point from which you wish to start a new recording.
2. Depress the PAUSE key when the editing point is reached.
3. Depress the REC key and release the PAUSE key. This permits you to record the new programme immediately following a previously recorded programme.

During audio dubbing:

1. Play back the tape and locate the point from which you wish to start dubbing the sound.
2. Depress the PAUSE key.
3. Depress the AUDIO DUB key and release the PAUSE key.

Notes:

- When the tape is stopped with the PAUSE key during recording, the playback picture may become distorted for a moment. However, this is normal and a clear picture will soon return.
- Avoid holding the PAUSE key depressed for more than ten minutes to prevent damage to the tape. When stopping the tape for more than ten minutes, depress the STOP key.
- After using the PAUSE key, be sure to depress again to release.

TIMER/SLEEP switch

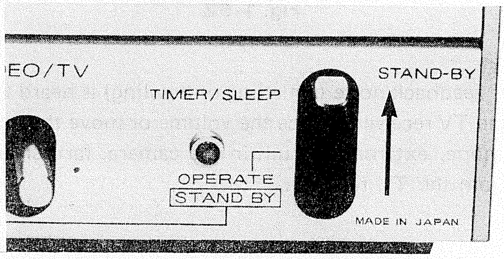


Fig. 1-59

The STAND-BY switch has a position marked TIMER/SLEEP. The sleep function provides automatic unit power off switching when you wish to record a late night programme without viewing.

1. Start recording the same way as an ordinary recording.
2. Set the operation switch to TIMER/SLEEP. Now you can fall asleep.
3. After the recording is completed, the power will be automatically turned off.

Notes:

- First start recording with the STAND-BY switch at OPERATE, then shift the switch to TIMER/SLEEP.
- TV power is not switched off. Before you go to sleep, switch off the TV receiver.
- When you awake, after using the sleep function, do not forget to turn the STAND-BY switch to STAND-BY.

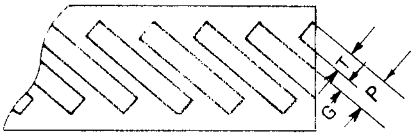
1-23 GENERAL DESCRIPTION OF VHS

1-23-1 VHS standard

The new VHS video system differs completely from previous EIAJ-1 or U-format systems and is a highly advanced video system which realizes a drastic reduction in tape consumption (about one-sixth), thus making the recorder more compact and lightweight. The development of completely new techniques eliminated the problems resulting from reducing the drum diameter by half.

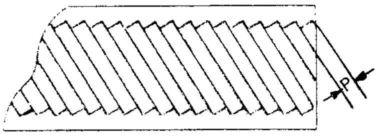
The following describes the VHS standard and new techniques which made the VHS standard possible.

1-23-2 VHS tape pattern



T (Video track) = Min. 100 μm
G (Guard band) = Min. 40 μm
P (Pitch) = 173 μm

(a) Conventional video tape pattern (EIAJ-1 standard)



P = 49 μm

(b) VHS standard video pattern

Fig. 1-60

As can be seen from these patterns, the new VHS video tape does not utilize a guard band (spacing between adjacent channels), as do other video tapes, to prevent crosstalk between channels due to tracking error. The VHS system employs a completely different method of eliminating crosstalk with the azimuth recording and phase-shift color recording systems. 3-hour recording on one cassette is now possible because of the high density recording system using a new tape pattern and new narrow-gap video head.

1-23-3 Narrow-gap video head

The heart of the VTR is the video head, i.e. rotary drum. Therefore, to obtain a truly lightweight, small size recorder, the rotary drum must be reduced in size. However, a reduction in the drum size will cause the tape-head relative velocity to decrease, which leads to deterioration in picture quality.

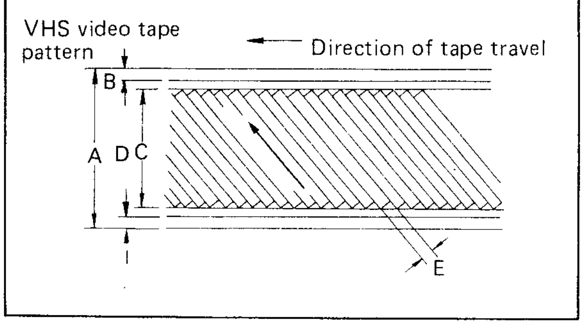


Fig. 1-61

Metric

	Tape speed	23.39 mm/s
A	Tape width	12.65 mm
B	Audio track	1.0 mm
C	Video tracks	10.6 mm
D	Control track	0.75 mm
E	Width of video track	0.049 mm

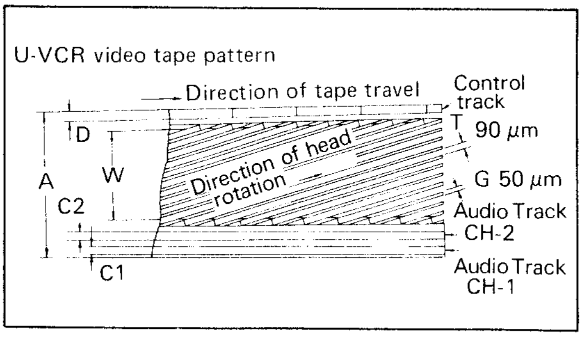
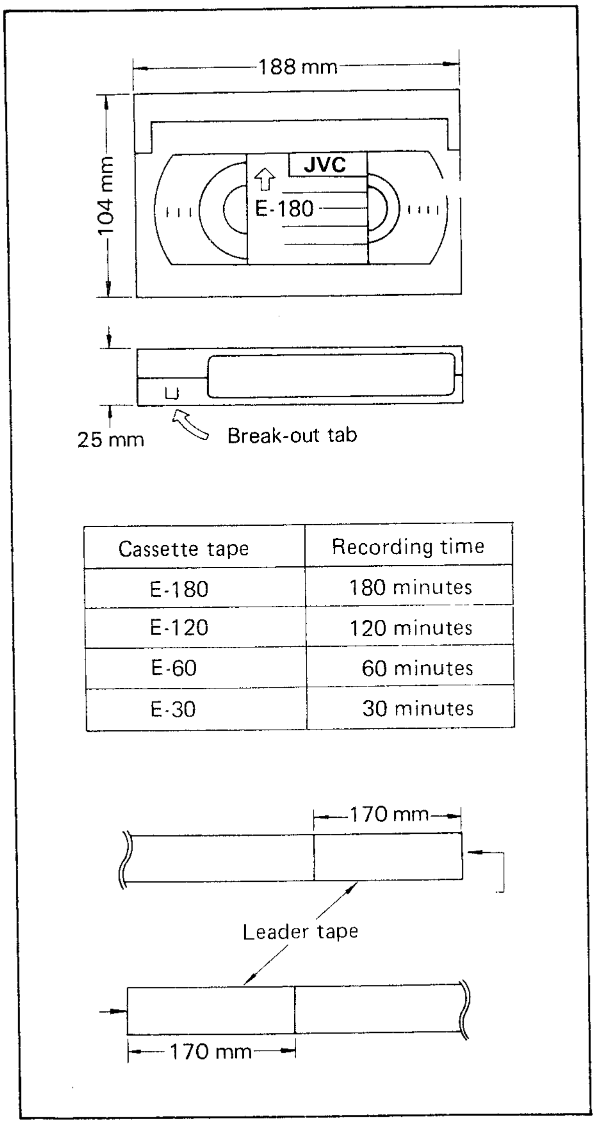


Fig. 1-62

Metric

	Tape speed	9.53 cm/s
(A)	Tape width	19.00 mm
(W)	Video tracks	14.8 mm
(T)	Width of video track	0.090 mm
(G)	Width of guard band	0.050 mm
(D)	Control track	0.6 mm
(C_1)	Audio track CH-1	0.8 mm
(C_2)	Audio track CH-2	0.8 mm

VHS casset



Cassette tape	Recording time
E-180	180 minutes
E-120	120 minutes
E-60	60 minutes
E-30	30 minutes

Fig. 1-63

As is well known, S/N ratio and resolution are major factors in determining picture quality, thus to increase the S/N ratio and resolution, the recorder must have the ability to record high frequency signals.

The following relationship exists between tape-head relative velocity, recordable wavelength and video head gap.

The recordable wavelength on tape is determined by the formula:

$$\text{Wavelength recorded on tape } (\lambda) = \frac{\text{Relative velocity (v)}}{\text{Signal frequency (f)}}$$

$$\text{Head gap (g)} \leqq \frac{\text{Minimum wavelength recorded on tape } (\lambda)}{2}$$

Thus, as relative velocity decreases, the wavelength recorded on the tape will also decrease accordingly.

In order to make recording and playback of the signal possible, the head gap must be less than the wavelength of the signal. Therefore, if the drum diameter is reduced that mean relative velocity is decreased, the head gap must also be made smaller. The reduction in drum diameter by a half required a reduction in the head gap of from 0.7—1.0 μm to only 0.3 μm. And JVC succeeded in this remarkable feat due to its outstanding development capability.

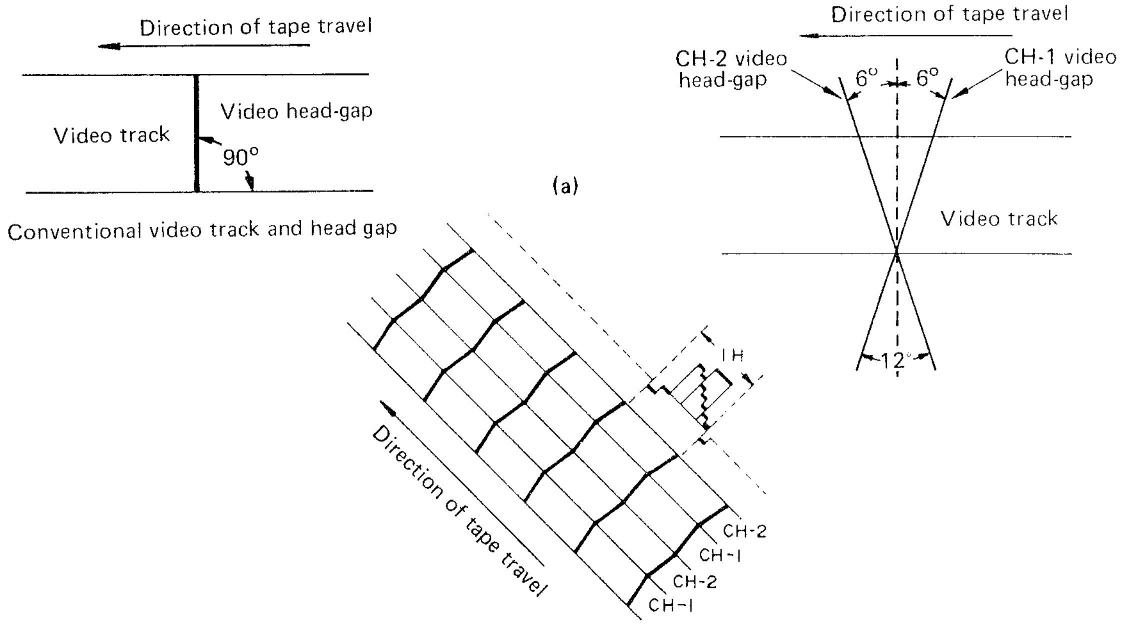
1-23-4 Azimuth recording system

When the guard band is removed, with a conventional recording system, crosstalk elimination is impossible, even if optimal tracking is obtained in each channel during playback.

Therefore, in the VHS system the two video head-gaps are each biased 6° in the opposite direction to the video track. This means that a 12° difference exists between the two. A head-gap angle comparison between conventional system and the VHS system is shown in Fig. 1-64.

It is obvious that if a CH-1 recorded track is played back by the CH-1 head with no tracking error, so there is no azimuth loss. If a CH-2 recorded track is played back by the CH-1 head due to a tracking error, the 12° azimuth angle between the channels assure reproduction with almost no crosstalk. However, one problem still remains in that the lower frequencies are affected less by azimuth losses than high frequencies. Therefore, the system would be less effective at low frequencies (color signal) but compensation is performed as shown in 1-23-5. In the VHS system, the colour signal is separated from a luminance component.

The luminance signal component is then converted into an FM signal having a deviation from 3.8 MHz (Sync) to 4.8 MHz (peak white), and the chrominance signal component converted into a low frequency (627 kHz) signal. The azimuth loss, with a 12° angle between the two channels, at the above frequencies of 3.8 MHz, 4.8 MHz and 627kHz are as shown in Fig. 1-65. If the relative 12° head gap angle is adopted, practically no crosstalk remains, with regard to the luminance signal component, but crosstalk from the converted chrominance signal cannot be fully eliminated with only the azimuth system, because of its low frequencies. Now, however, JVC has developed the phase-shift colour recording system which eliminates chrominance signal crosstalk.


Direction of tape travel
Video track
Video head-gap
90°
Conventional video track and head gap
(a)
Direction of tape travel
CH-2 video head-gap
CH-1 video head-gap
6°
6°
Video track
12°
1 H
Direction of tape travel
CH-2
CH-1
CH-2
CH-1

(b) VHS standard video pattern

Fig. 1-64

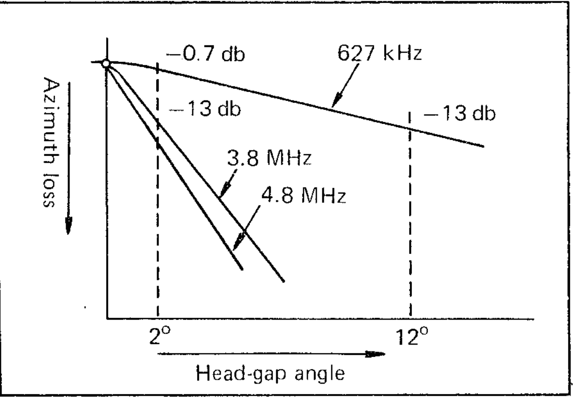


Fig. 1-65 Characteristics of the azimuth loss

1-23-5 Phase shift colour recording system

The phase-shift recording system for the chrominance signal, shown in the block diagram (Fig. 1-67) eliminates chrominance signal crosstalk from neighboring tracks.

By this phase-shift colour recording system, only the CH-2 chrominance signal component is phase-delayed 90° every 1-H.

Figure 1-68 shows a vector-like display of the signal phases on the tape pattern produced by this system.

When the CH-2 track is played back with the CH-2 head, the signal components are reproduced, with the phase advanced 90° every 1-H from B1, B2, B3 . . . , and the crosstalk components reproduced in the same way with a 90° delay from A1, A2, A3 . . . . .

The A-crosstalk (CH-1) components are eliminated by utilizing the 2-H delay line filter.

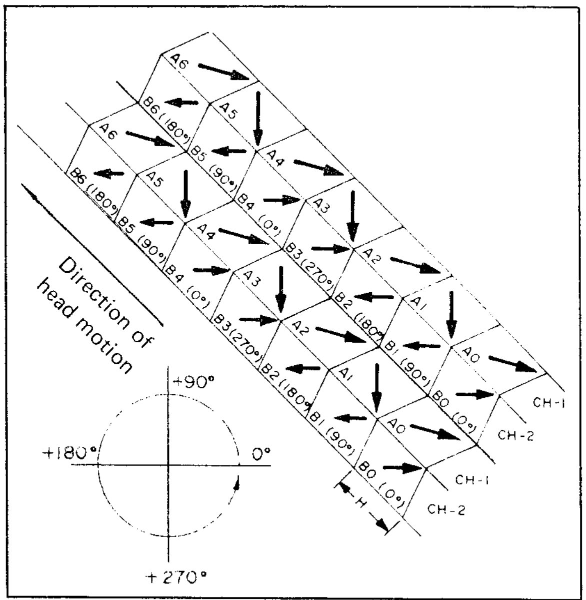
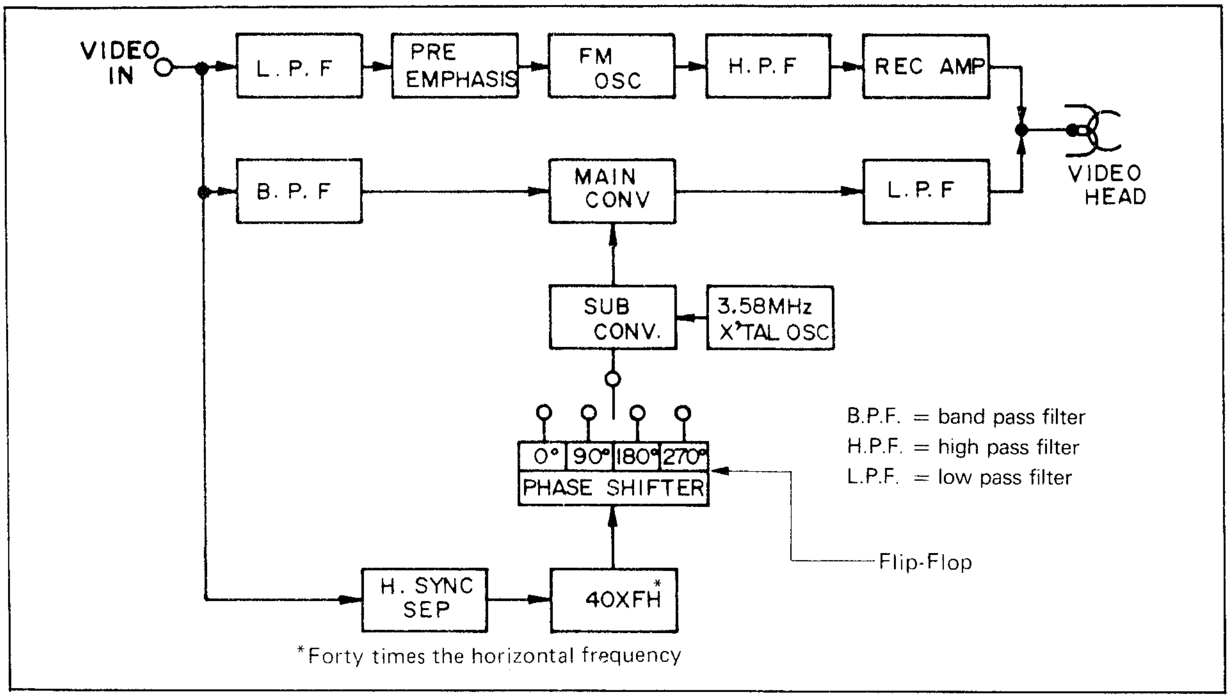

A6
B6(180°)
A5
B5(90°)
A4
B4(0°)
A3
B3(270°)
A2
B2(180°)
A1
B1(90°)
A0
B0(0°)
Direction of head motion
+90°
+180°
0°
+270°
CH-1
CH-2
CH-1
CH-2
H

Fig. 1-66



*Forty times the horizontal frequency

Fig. 1-67 Block diagram of phase-shift color recording system

1-23-6 2-H delay line filter function

The purpose of this filter is as follows:

1. Delay the signal by 2-H.
2. Pass only the colour signal components.

When 2-H delayed output signal "X" and filter bypass signal "Y" are combined,

Signal components: $B_0 + B_1, B_1 + B_2, B_2 + B_3$ ....

Crosstalk components: $A_0 + A_1, A_1 + A_2, A_2 + A_3$ ....

Since each of the color television scanning lines can be considered to have essentially the same signal as its 2-H scanning line. Consequently, the signal component is almost doubled. On the other hand, the crosstalk components cancel each other out, and as a result, crosstalk is eliminated.

1-23-7 Pre-emphasis characteristics and double limiter

According to the VHS standard, the video track width has been reduced to 49 µm to accommodate the slower tape speed for longer recording time. Decreasing the track width is known to cause deterioration in the signal-to-noise ratio, and the following measures were taken to improve the signal-to-noise ratio.

The magnetic recording/playback characteristics of FM signals are such that the higher the frequency the higher the noise. Therefore, to compensate for this characteristic, the signal is pre-emphasized in recording, to make it clearly stand out from noise. The stronger the pre-emphasis, the greater the improvement in the signal-to-noise ratio. However, extremely sharp overshoot or undershoot occurs with sharp video signal rise or fall, and frequency modulation under such a condition will result in over-modulation. As a result, the lower sideband amplitude increases, and the modulated wave generates AM components in demodulation to produce a negative conversion picture causing extreme deterioration of the S/N ratio in the particular section. This is illustrated in Fig. 1-69.

If only the amplitude center is passed through a limiter by changing the circuit constants, the low FM signal frequencies are attenuated and the important sideband components are lost, thus producing an extremely low-resolution picture.

The double-limiter solves these problems.

As shown in Fig. 1-70, the playback FM signal is separated through low-pass and high-pass filters into carrier and low-frequency sideband components.

First only the carrier component is passed through a limiter, then after being mixed with the sideband component, is again passed through another limiter.

In other words, the ratio between the carrier and sideband components is compensated in the circuit to assure a complete carrier. Accordingly, the signal-to-noise ratio is improved by a great amount of pre-emphasis without deterioration in resolution.

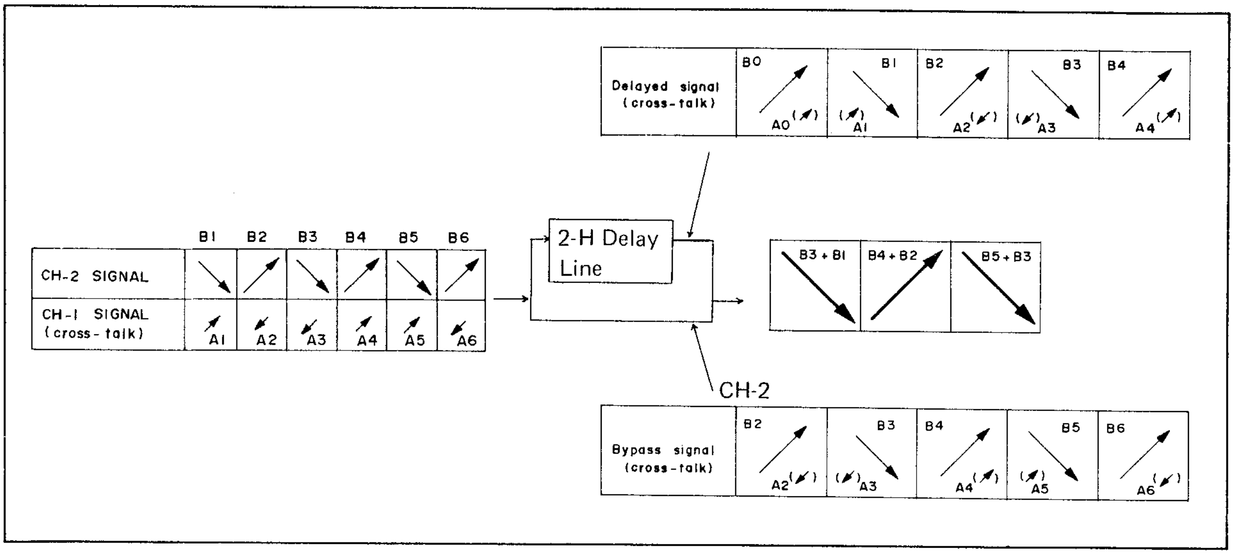

Delayed signal (cross-talk)
B0
B1
B2
B3
B4
A0
A1
A2
A3
A4
2-H Delay Line
B1 B2 B3 B4 B5 B6
CH-2 SIGNAL
CH-1 SIGNAL (cross-talk)
A1 A2 A3 A4 A5 A6
B3+B1
B4+B2
B5+B3
CH-2
Bypass signal (cross-talk)
B2
B3
B4
B5
B6
A2
A3
A4
A5
A6

Fig. 1-68

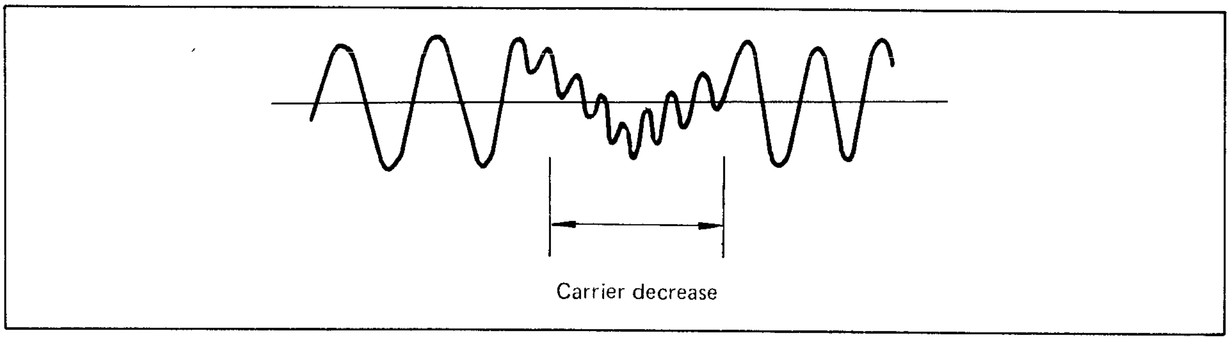

Carrier decrease

Fig. 1-69

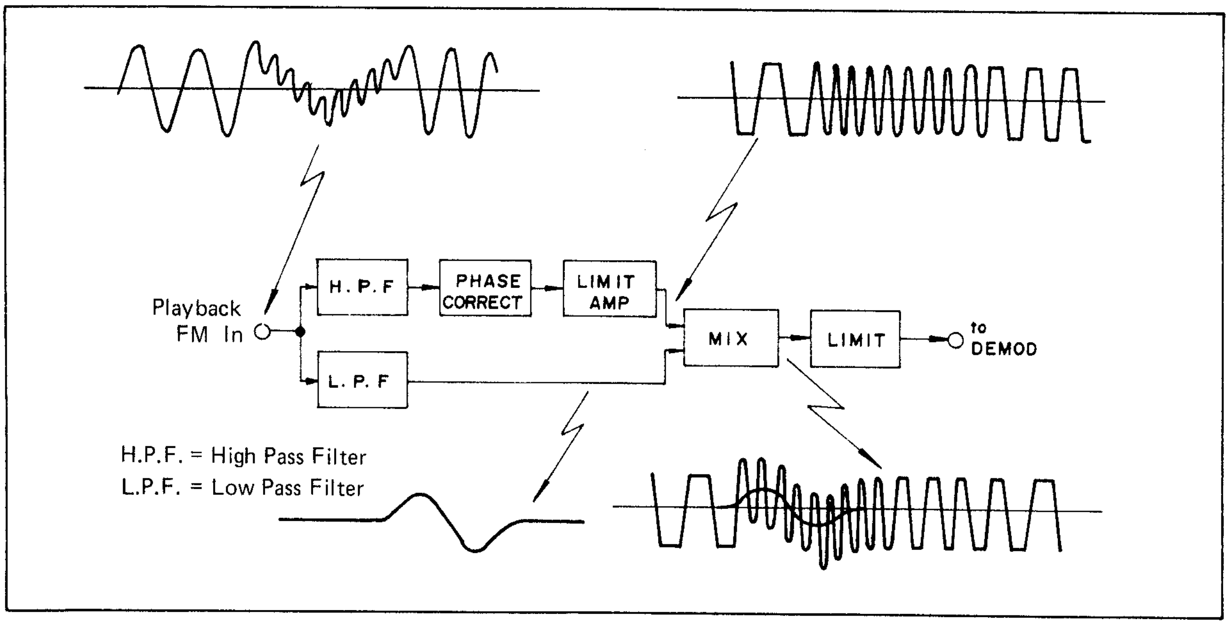

Playback FM In
H. P. F
PHASE CORRECT
LIMIT AMP
L. P. F
MIX
LIMIT
to DEMOD
H.P.F. = High Pass Filter
L.P.F. = Low Pass Filter

Fig. 1-70

1-23-8 New loading system (Parallel loading system)

The video cassette tape requires a mechanism to extend the tape from the cassette and load it on the video head. In the conventional U-format VCR, JVC adlpted the double loading system to prevent damage to the tape. The mechanism called the "loading ring" or "loading arm" is turned to position the tape around the rotary video head. This results in increasing the tape loading time and makes the mechanism more complicated.

The loading system employed by VHS models boasts a simplified mechanism, and greatly reduced loading time. The chart shows the principle of the new loading system. In the new VHS system, two loading arms — one for take-up and the other for supply — are employed to extend the tape from the cassette and position it on the rotary video head. The parallel or "M" (because of the shape of the tape path) loading system has been named after this. This simplified mechanism also permits a faster loading time of about 2 seconds.

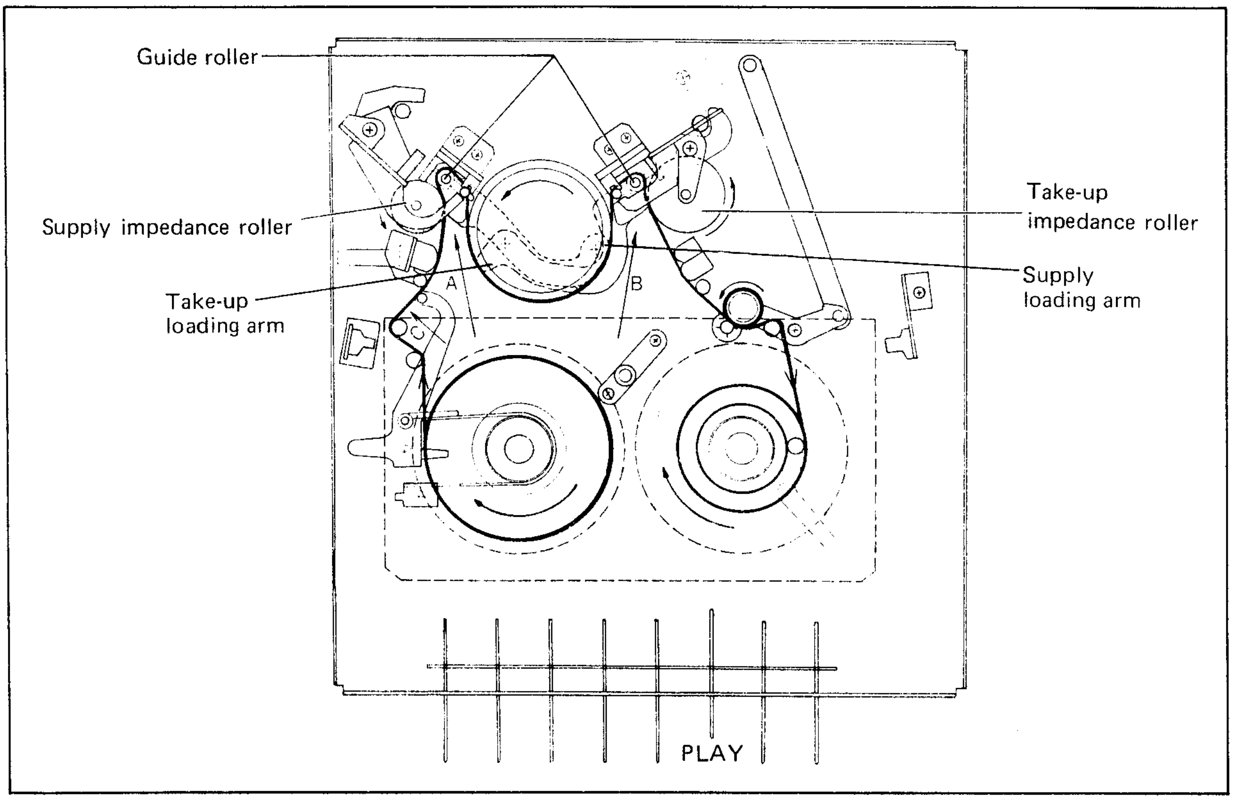


Fig. 1-71 Parallel loading system

SECTION 2
MECHANISM DESCRIPTION

2-1 GENERAL

The video cassette recorder "HR-3300E" does not require tape to be manually threaded as with an open-reel type video tape recorder.
Instead, a special action for automatically loading and unloading tape is provided. Each operation of this "HR-3300E" other than insertion or removal of the cassette is controlled by one key, except record, which for prevention of accidental erasure, requires two keys to be depressed. This means, pressing any one of the control keys sets up the mechanism to control all the assemblies used in that mode.
In addition, to prevent damage to the tape or the "HR-3300E" it is necessary to go to STOP when switching one mode to another.
The main actions of the "HR-3300E" mechanism are described below.

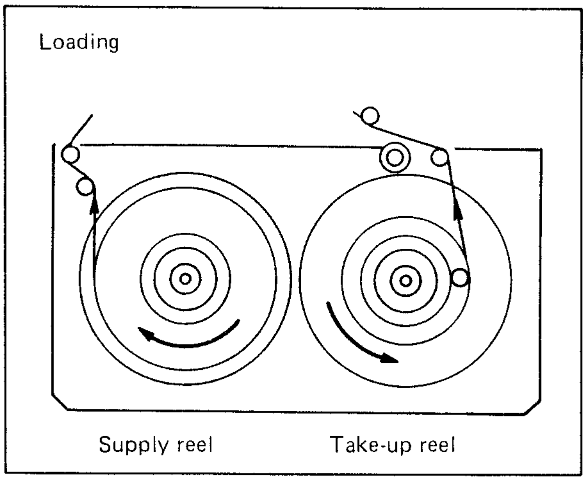


Fig. 2-1(a)

2-2 BASIC ACTION

2-2-1 Inserting and removing the video cassette

When the EJECT key is pressed, the cassette housing is lifted upward so the cassette can be easily loaded. Insert the cassette into the cassette housing completely. Then push the cassette cover downward by hand.
When removing a cassette, make sure the unit is in the Stop mode.

2-2-2 STOP to PLAY (loading)

Insert the video cassette and press the PLAY key. At that time, tape is pulled out from the cassette for loading. After tape loading is finished, the tape starts traveling and a playback picture appears on the TV monitor. As shown in Fig. 2-1(a), tape is pulled from the supply reel and take-up reel during loading. After the tape starts traveling, it is wound onto the take-up reel disk, while being pulled from the supply reel, as shown in Fig. 2-1(b).

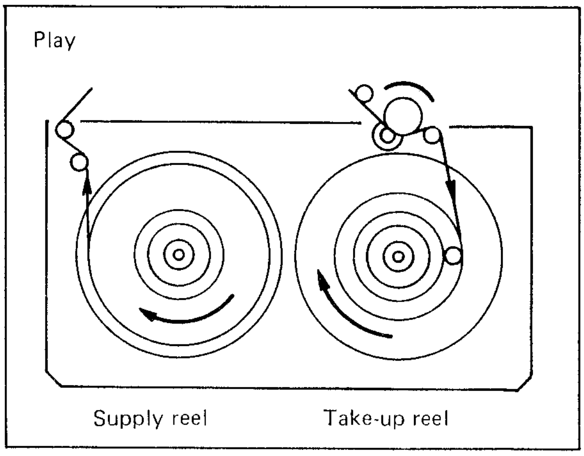


Fig. 2-1(b)

2-2-3 PLAY to STOP (unloading)

When the STOP key is pressed, the PLAY key is released from the lock. A fraction of a second later, unloading starts. During the unloading mode, the tape is wound onto the supply reel.

2-2-4 STOP to REW (Rewind mode)

When the REW key is pressed, the rewind mechanism is locked by the function mechanism. At the same time tape is rewound from the take-up reel to the supply reel as shown in Fig. 2-2. Pressing the STOP key to stop the tape and the REW key is released from the lock.

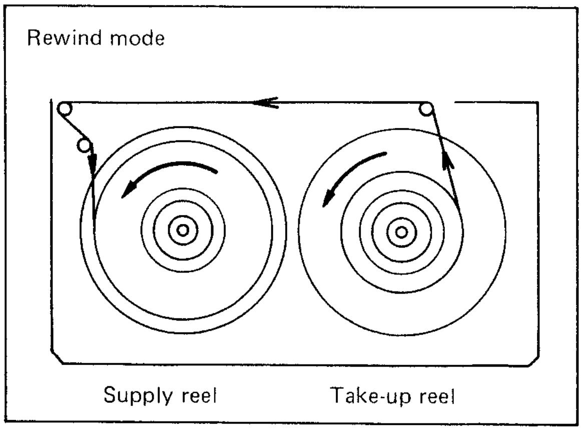


Fig. 2-2

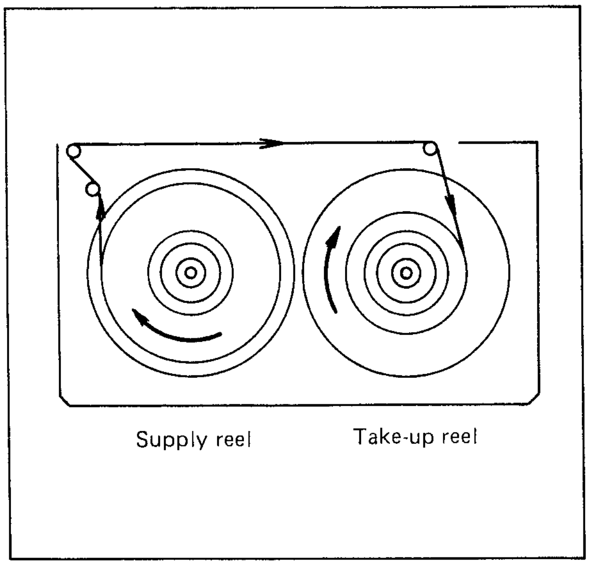


Fig. 2-3 F.F. mode

2-2-5 STOP to F.F. (Fast forward mode)

When the F.F. (fast-forward) key is pressed, it is held by the function mechanism. At the same time, tape is rapidly wound from the supply reel to the take-up reel as shown in Fig. 2-3. Pressing the STOP key stops the tape and the F.F. key is released.

2-2-6 PAUSE mode

The tape traveling is stopped when the PAUSE key is pressed in Play or Record mode and an E-E picture can be seen on the TV monitor. In Pause mode, the mechanism actions are the same as in the Play mode, except that the pinch roller is released from the capstan shaft and the take-up idler released from the take-up disk, so that tape traveling is stopped. When the PAUSE key is pressed again, the tape starts traveling again.

2-2-7 Automatic stop system (photo transistor operation)

Automatic stop is initiated when the photo transistor operates at the beginning or end of the tape in Play/Record, Rewind or Fast Forward mode.

1. As shown in Fig. 2-4(a), when rewinding to the beginning of the tape, the beam from the cassette lamp reaches the start sensor (photo transistor) through the clear leader tape, and the unit will stop automatically. Also, when clear leader is already present, the Rewind mode will not operate.
2. As shown in Fig. 2-4(b), when the light beam from the cassette lamp reaches the end sensor when in the Play/Record or Fast Forward mode, the unit will be stopped automatically. Also, when the light beam shines on the end sensor (photo transistor), Play/Record or Fast Forward modes will not operate.

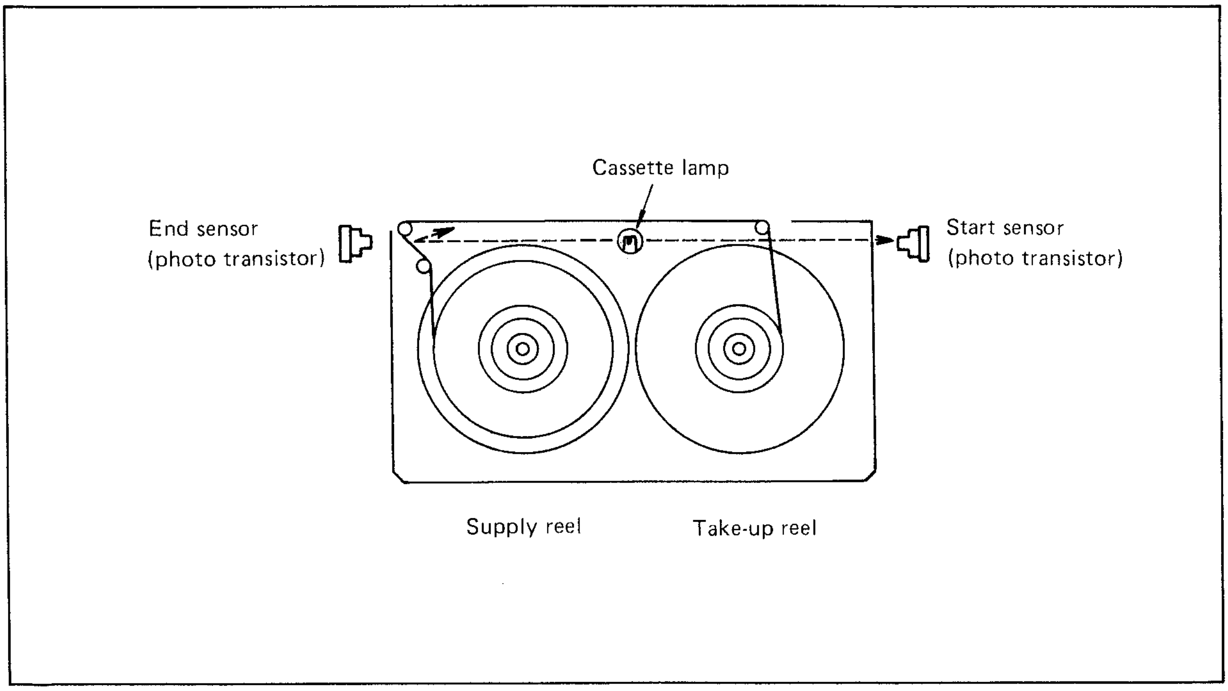


Fig. 2-4(a) Beginning of the tape

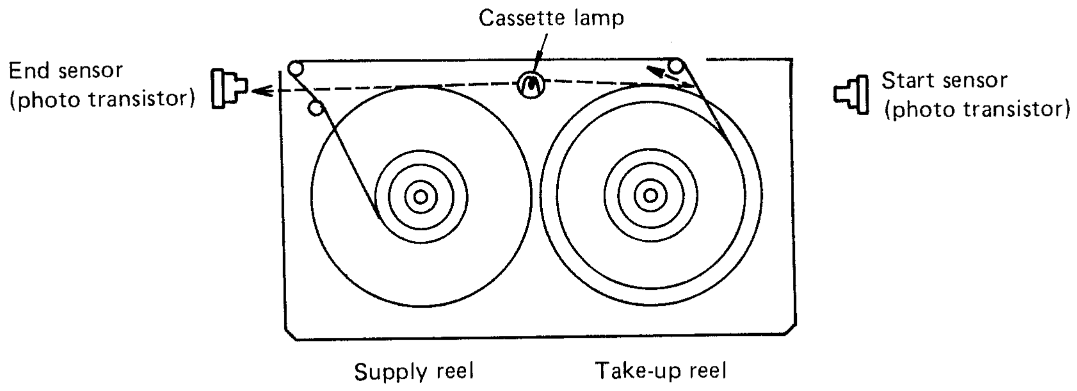

Cassette lamp
End sensor
(photo transistor)
Start sensor
(photo transistor)
Supply reel
Take-up reel

Fig. 2-4(b)

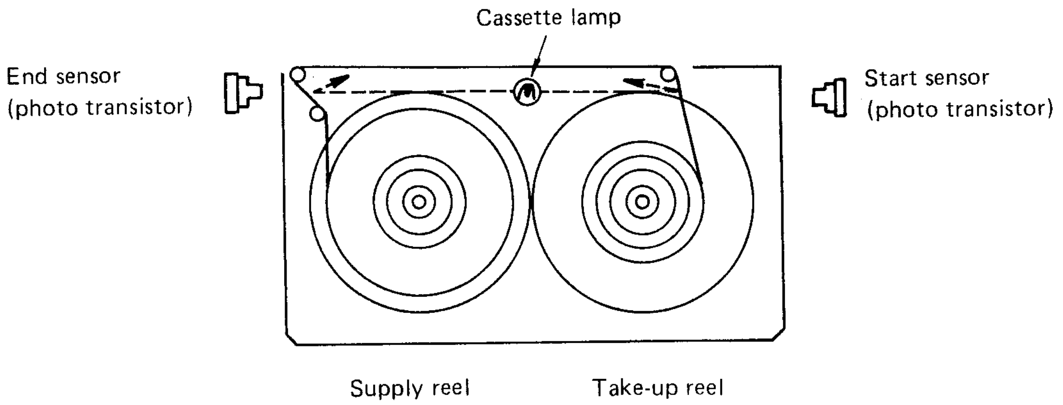

Cassette lamp
End sensor
(photo transistor)
Start sensor
(photo transistor)
Supply reel
Take-up reel

Fig. 2-4(c)

3. When the light beam is interrupted by the video tape as shown in Fig. 2-4 (c), all modes are available by pressing the corresponding key.

2-3 FUNCTION OF MAIN COMPONENTS

2-3-1 Capstan motor

Refer to Fig. 2-5.

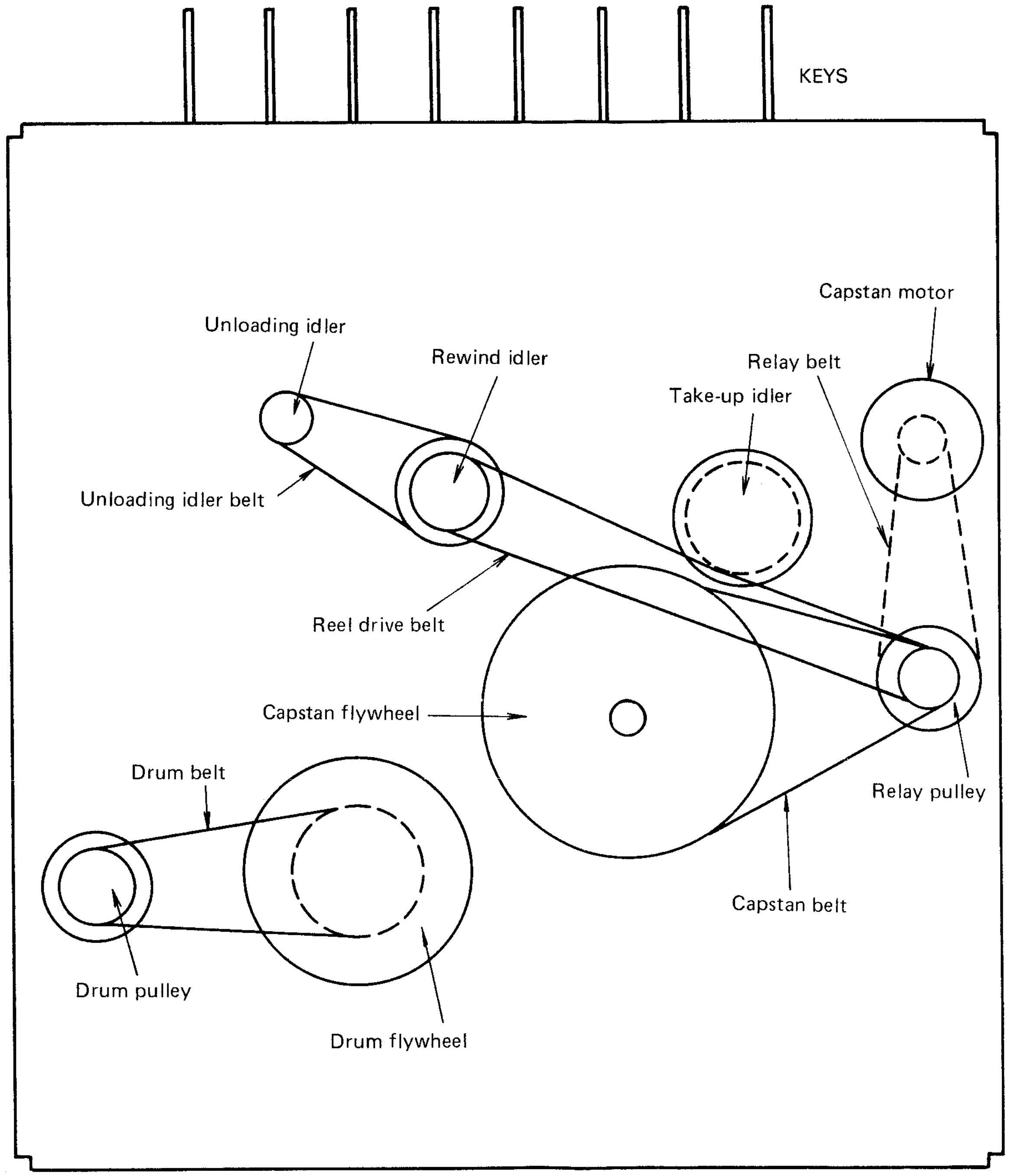
The capstan motor is a DC motor, which is controlled at a constant speed by a servo circuit. The rotation of the capstan motor is transmitted to the relay pulley, via the relay belt, and the relay pulley rotation is transmitted to the capstan flywheel via the capstan belt. On the other hand, the rotation of the relay pulley is transmitted to the rewind idler and the take-up idler via the reel drive belt, and the rotation of the rewind idler is transmitted to the unloading idler via the unloading idler belt. In short, all the above operations are made by the DC capstan motor. The capstan motor powers all the driving system such as the capstan shaft, take-up reel disk, and so forth.

2-3-2 Drum motor

As shown in Fig. 2-5, the rotation of the drum motor is transmitted to the drum pulley via a belt. The drum motor's rotation is controlled by the servo circuit.

2-3-3 Mode solenoid

When the automatic stop system operates, the mode solenoid operates to release the function keys.


KEYS
Capstan motor
Unloading idler
Rewind idler
Relay belt
Take-up idler
Unloading idler belt
Reel drive belt
Capstan flywheel
Drum belt
Relay pulley
Capstan belt
Drum pulley
Drum flywheel

(With VHS standing on its end)

Fig. 2-5 DC motor drive mechanism

2-4 LAYOUT OF MAIN MECHANICAL AND ASSOCIATED PARTS

– TOP VIEW –

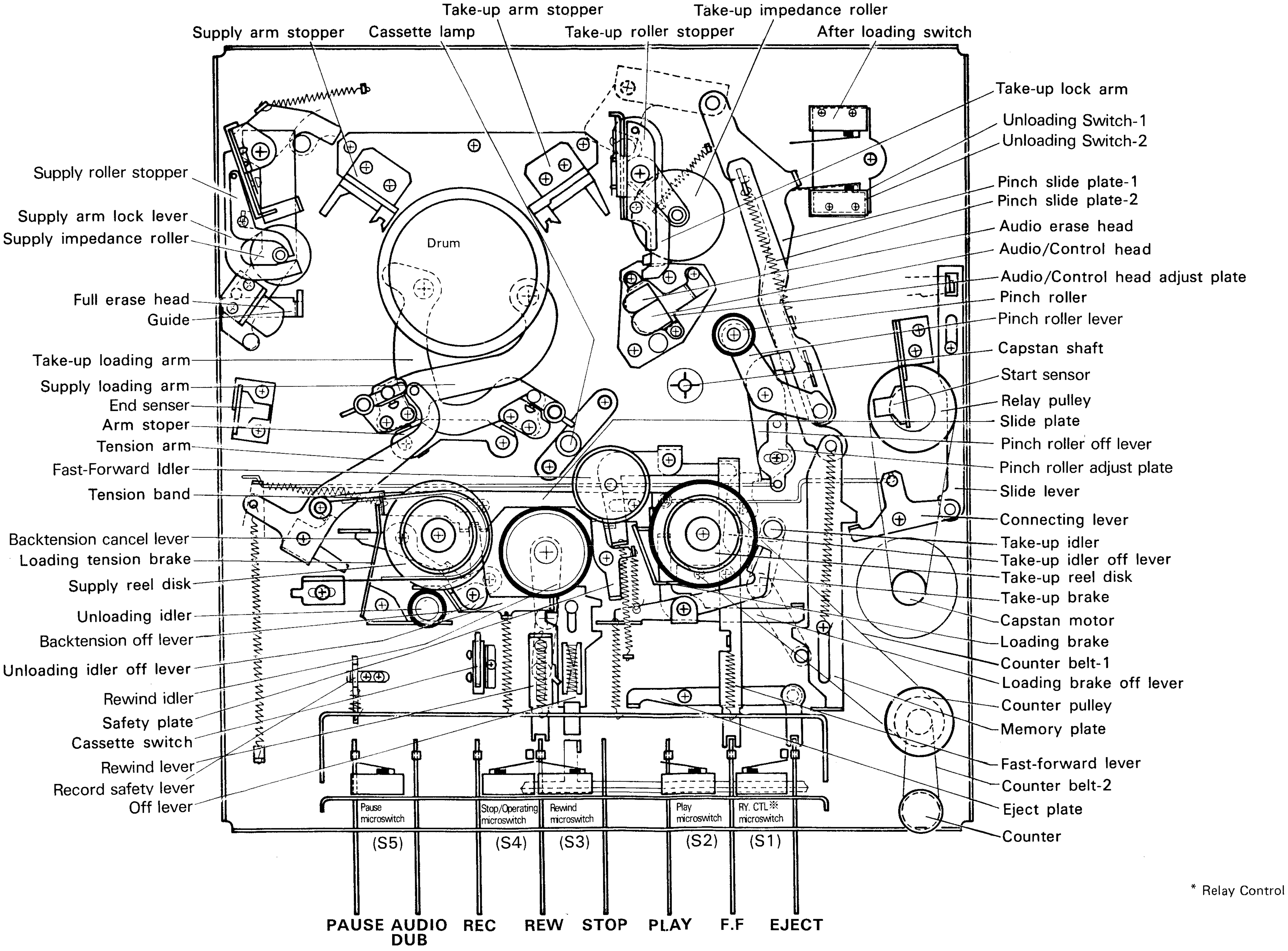

Take-up arm stopper
Take-up impedance roller
Supply arm stopper
Cassette lamp
Take-up roller stopper
After loading switch
Supply roller stopper
Supply arm lock lever
Supply impedance roller
Full erase head
Guide
Take-up loading arm
Supply loading arm
End senser
Arm stoper
Tension arm
Fast-Forward Idler
Tension band
Backtension cancel lever
Loading tension brake
Supply reel disk
Unloading idler
Backtension off lever
Unloading idler off lever
Rewind idler
Safety plate
Cassette switch
Rewind lever
Record safety lever
Off lever
Drum
Take-up lock arm
Unloading Switch-1
Unloading Switch-2
Pinch slide plate-1
Pinch slide plate-2
Audio erase head
Audio/Control head
Audio/Control head adjust plate
Pinch roller
Pinch roller lever
Capstan shaft
Start sensor
Relay pulley
Slide plate
Pinch roller off lever
Pinch roller adjust plate
Slide lever
Connecting lever
Take-up idler
Take-up idler off lever
Take-up reel disk
Take-up brake
Capstan motor
Loading brake
Counter belt-1
Loading brake off lever
Counter pulley
Memory plate
Fast-forward lever
Counter belt-2
Eject plate
Counter
Pause microswitch
Stop/Operating microswitch
Rewind microswitch
Play microswitch
RY. CTL※ microswitch
(S5)
(S4)
(S3)
(S2)
(S1)
PAUSE
AUDIO DUB
REC
REW
STOP
PLAY
F.F
EJECT
* Relay Control

Fig. 2-6 (a) STOP mode mechanism (TOP VIEW)

—BOTTOM VIEW —

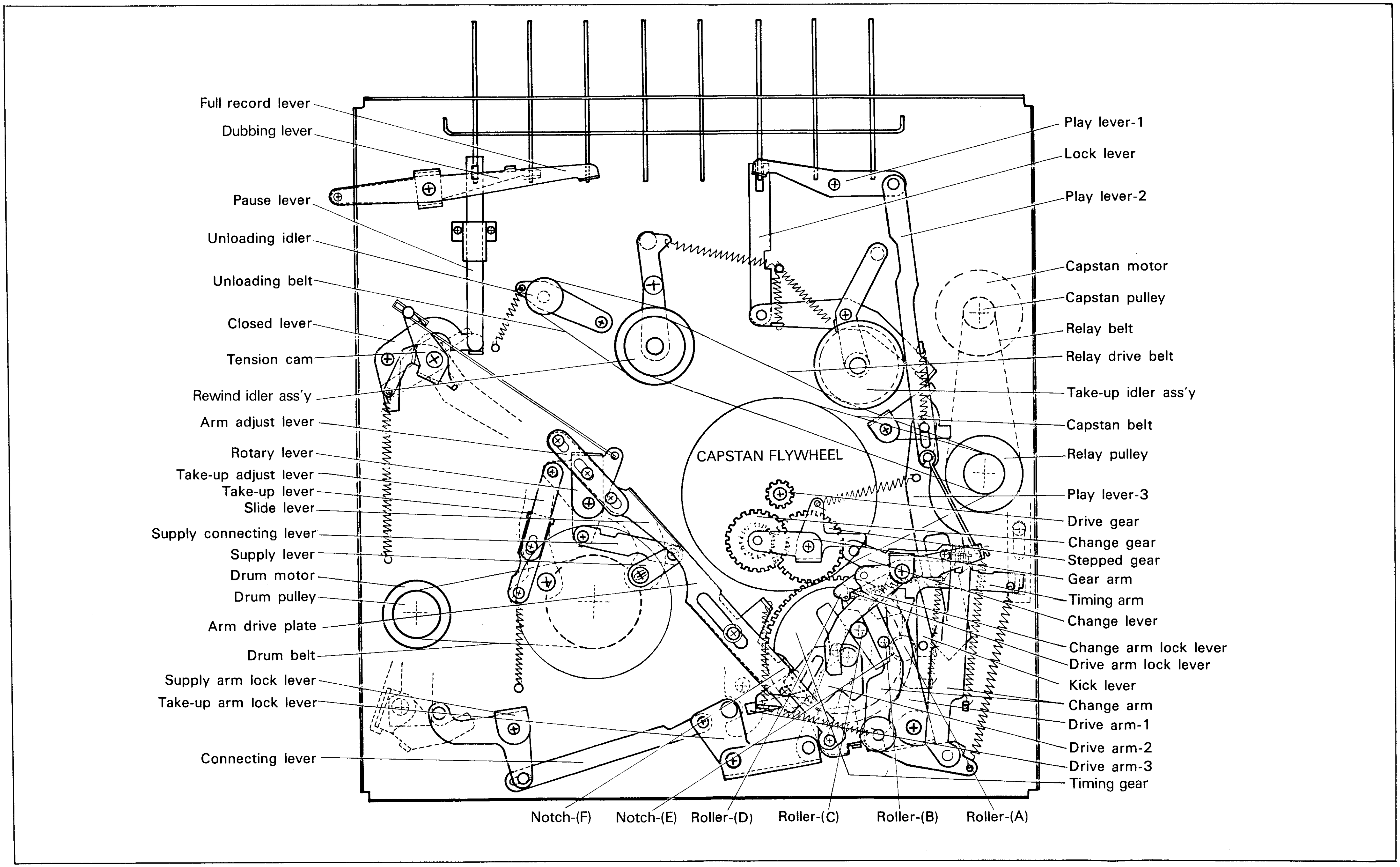

Full record lever
Dubbing lever
Pause lever
Unloading idler
Unloading belt
Closed lever
Tension cam
Rewind idler ass'y
Arm adjust lever
Rotary lever
Take-up adjust lever
Take-up lever
Slide lever
Supply connecting lever
Supply lever
Drum motor
Drum pulley
Arm drive plate
Drum belt
Supply arm lock lever
Take-up arm lock lever
Connecting lever
Play lever-1
Lock lever
Play lever-2
Capstan motor
Capstan pulley
Relay belt
Relay drive belt
Take-up idler ass'y
Capstan belt
Relay pulley
Play lever-3
Drive gear
Change gear
Stepped gear
Gear arm
Timing arm
Change lever
Change arm lock lever
Drive arm lock lever
Kick lever
Change arm
Drive arm-1
Drive arm-2
Drive arm-3
Timing gear
CAPSTAN FLYWHEEL
Notch-(F)
Notch-(E)
Roller-(D)
Roller-(C)
Roller-(B)
Roller-(A)

Fig. 2-6 (b) Stop mode mechanism (BOTTOM VIEW)

2-5 STOP MODE MECHANISM

Refer to Fig. 2-6 (a), (b).
Stop mode means the condition in which no manual keys are pressed, and the supply loading arm and the take-up loading arm are in the stop position, with the unloading switches pressed (on position). Also, unloading idler is pressed to supply reel disk and the take-up brake affects the take-up reel disk. Capstan and drum motors are stopped.
When the unit is in this condition, it is possible to press the EJECT key and to load or unload a cassette.

2-6 LOADING-1

When pressing the PLAY key after being in the Stop mode, the play lever-1, 2, 3 moves to arrows (a), (b), (c) as shown in Fig. 2-7.

By this pulling action of the play lever-3, the downward stud (D) on the change lever is pulled up at the top of the groove of the play lever-3, then the change lever is turned counterclockwise (d). As a result, the gear arm becomes free and starts rotation clockwise (e) being pulled by the force of the spring-2, then the change gear is pressed to the drive gear on the capstan shaft.
Accordingly, the rotation of the capstan motor is transmitted via a belt to the following, Capstan motor — Relay pulley — Capstan flywheel, Drive gear and change gear — Stepped gear — Timing gear.
In short, when the drive gear contacts with the change gear, the timing gear starts rotation clockwise. By this clockwise rotation, the roller (A) which is fixed on the timing arm and has been set in the notch (F) of the timing gear runs on edge of the timing gear. At this time, the timing arm moves to arrow (g) by the rotation of the timing gear, then the timing arm is locked by the edge of the timing gear.

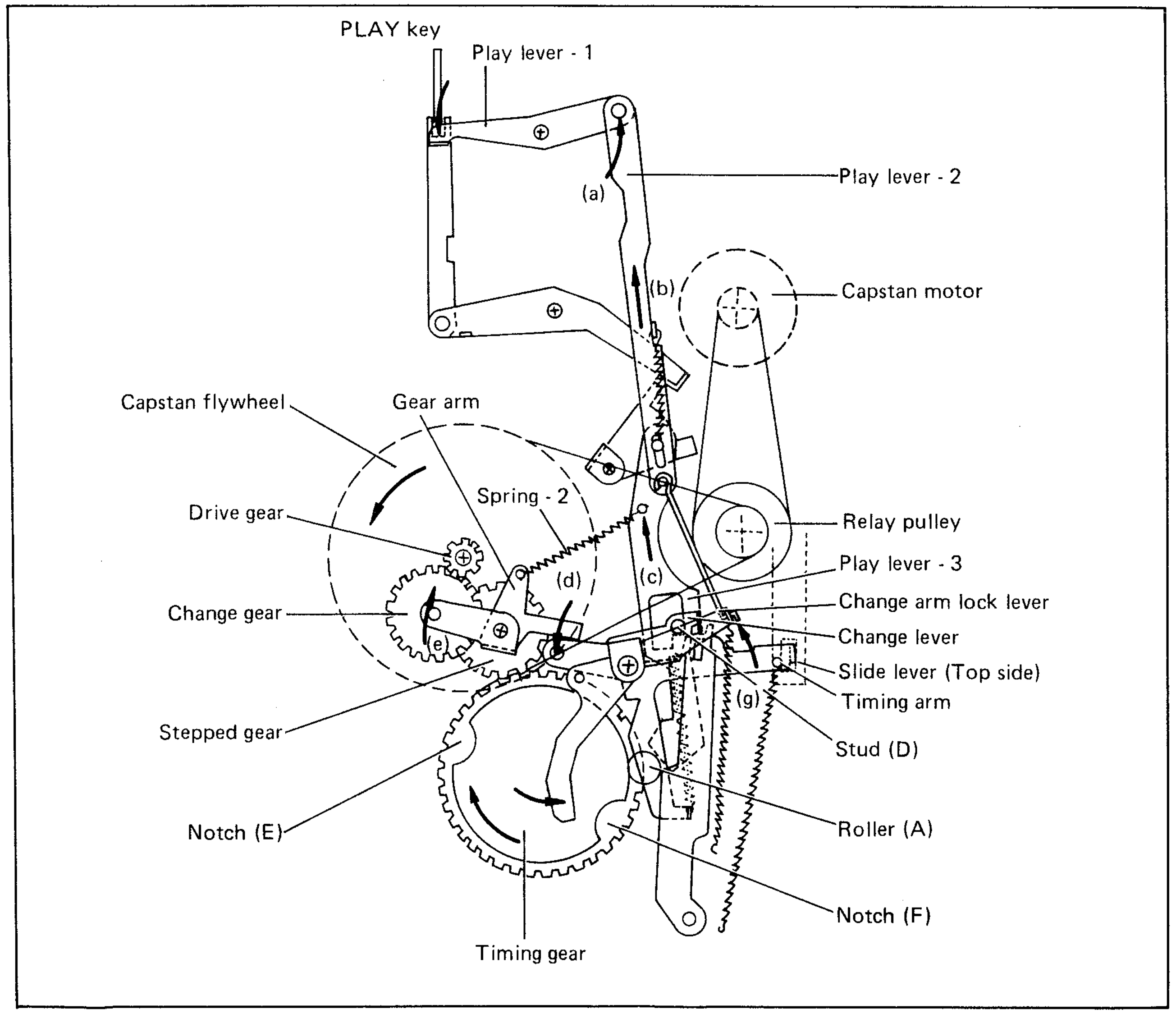

PLAY key
Play lever - 1
(a)
Play lever - 2
(b)
Capstan motor
Capstan flywheel
Gear arm
Spring - 2
Drive gear
Relay pulley
(d)
(c)
Play lever - 3
Change gear
(e)
Change arm lock lever
Change lever
Slide lever (Top side)
Timing arm
(g)
Stepped gear
Stud (D)
Notch (E)
Roller (A)
Notch (F)
Timing gear

Fig. 2-7 Loading-1 mechanism (Bottom view)

By the pulling action of the play lever-3, namely, the gear arm rotates to arrow (e) by the force of spring-2, so that the change gear contacts with the drive gear, then the timing gear starts clockwise rotation. However, the change arm lock lever moves to arrow (g) by the pulling action of the play lever-2 through the rod.
After that the timing gear continues its clockwise rotation.
Refer to Fig. 2-8 Loading-1 mechanism (Top view)
When the manual PLAY key is pressed, the play switch, relay control switch and operate switch are turned on, so that the capstan DC motor and drum DC motor both start rotation. At the same time, the off lever moves to arrow (a) by the function mechanism, so that the unloading idler releases from the supply reel disk by the movement of the unloading idler off lever, also the loading tension brake supplies to supply reel disk and the take-up brake releases from the take-up reel disk.
However, by the timing arm movement located in bottom side, see Fig. 2-7, the slide lever moves to arrow (e) and the connecting lever, memory plate and pinch roller slide plate -1, -2 moves to arrows (f), (g), (h) as shown in Fig. 2-8, so that the pinch roller and the take-up roller stopper mechanism moves to arrows (i), (k) for stand-by position. At this time, unloading switches-1 and -2 are in the off position.
Also, the slide plate moves to arrow (j) by the clockwise rotation (f) of the connecting lever, so that the loading tension brake and loading brakes supplies to the supply reel disk and the take-up reel disk. Also, the safety plate moves to arrow (e) to lock the off lever by the force of a spring.

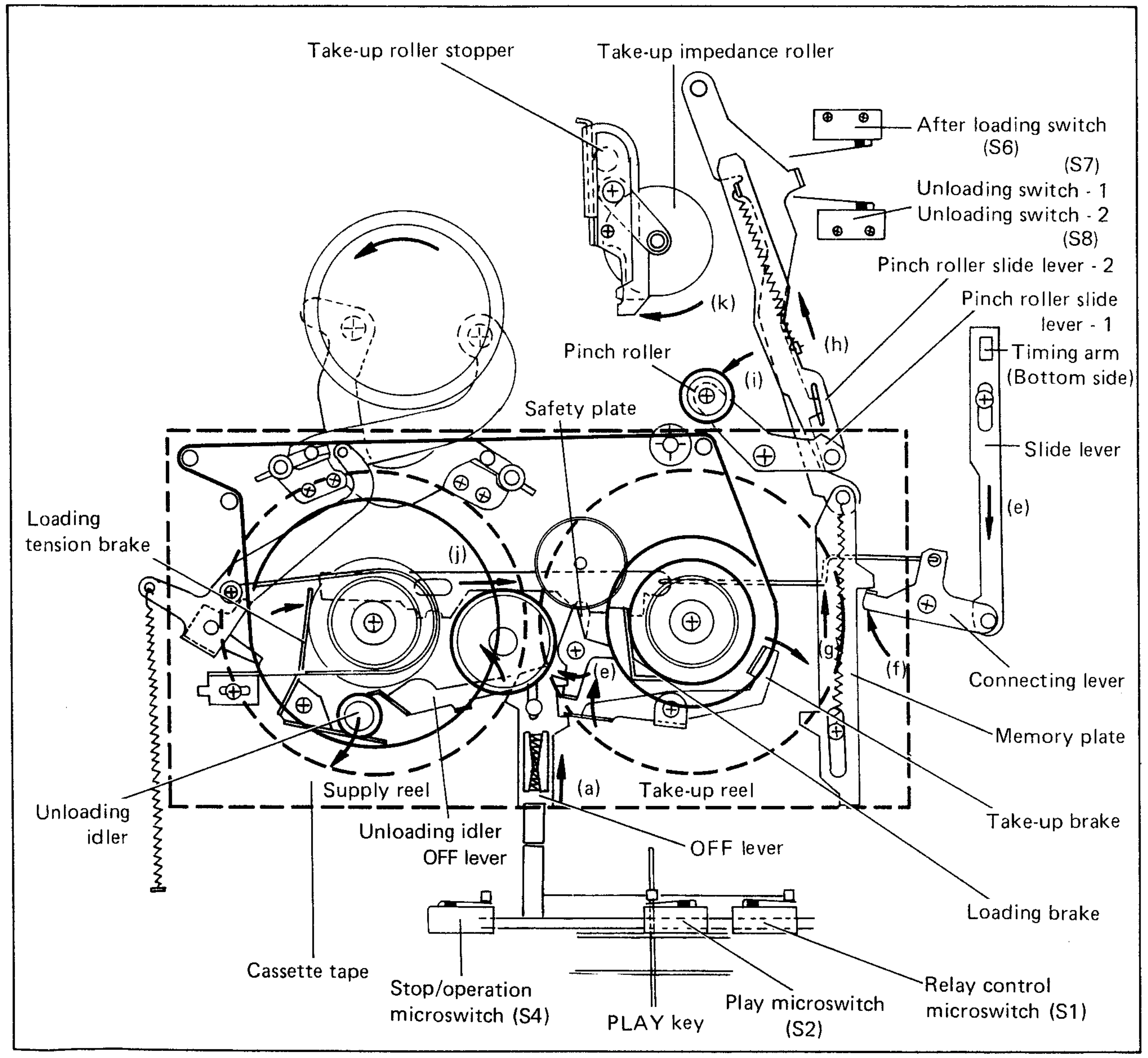

Take-up roller stopper
Take-up impedance roller
After loading switch
(S6)
(S7)
Unloading switch - 1
Unloading switch - 2
(S8)
Pinch roller slide lever - 2
Pinch roller slide lever - 1
Timing arm (Bottom side)
(k)
(h)
Pinch roller
(i)
Safety plate
Slide lever
(e)
Loading tension brake
(j)
(g)
(f)
(e)
Connecting lever
Memory plate
Take-up brake
Unloading idler
Supply reel
(a)
Take-up reel
Unloading idler OFF lever
OFF lever
Loading brake
Cassette tape
Stop/operation microswitch (S4)
PLAY key
Play microswitch (S2)
Relay control microswitch (S1)

Fig. 2-8 Loading-1 mechanism (Top view)

2-7 LOADING-2 MECHANISM

Refer to Fig. 2-9 Loading-2 mechanism (Bottom view)
Corresponding to the clockwise rotation (a) of the timing gear, the roller (C) fixed on the timing gear also makes clockwise rotation.
By this rotation of the roller (C), the drive arm is moved to arrow (b) and the change arm-1 and -2 also rotates counterclockwise (c) being pulled by the force of the spring connected with the timing arm. However, the rotation of the change arm-1 and -2 stops at the point that the roller (B), also fixed on the change arm-2, touches the change arm lock lever.
On the other hand, by the rotation of the roller (C), as shown in Fig. 2-10, namely the counterclockwise movement of the drive arm, the arm drive plate connected with the drive arm moves to arrow (d) and also the slide lever is pulled toward to arrow (d). Accordingly, the rotary lever starts clockwise rotation (e). By the clockwise rotation of the rotary lever, the take-up loading arm lever moved to arrow (f) and the take-up loading arm starts rotation clockwise to pull the video tape from the cassette. At the same time, also, the supply loading lever rotates counterclockwise (g) and the supply loading arm pulls the video tape from the cassette. By the clockwise rotation of the rotary lever, the tension arm cam rotates counterclockwise (h) by the pulling action of the rod. This frees the tension cam, which has locked the tension arm.
In short, the loading arm and the tension arm start operation by the movement of the drive arm.
As shown in Fig. 2-10, the rotary lever rotates clockwise (e) by the movement of the drive arm. As a result, the supply loading arm and the take-up loading arm are moved to arrows (a), (b) as shown in Fig. 2-11. And also, the tension arm is made free by the movement of the tension cam on the bottom side, and the tension arm rotates counterclockwise (c) by the force of the spring until the tension arm contacts with the backtension cancel lever. At this time, the backtension is not furnished to the supply reel disk. As the result, video tape is pulled from the cassette by the supply and take-up loading arm.

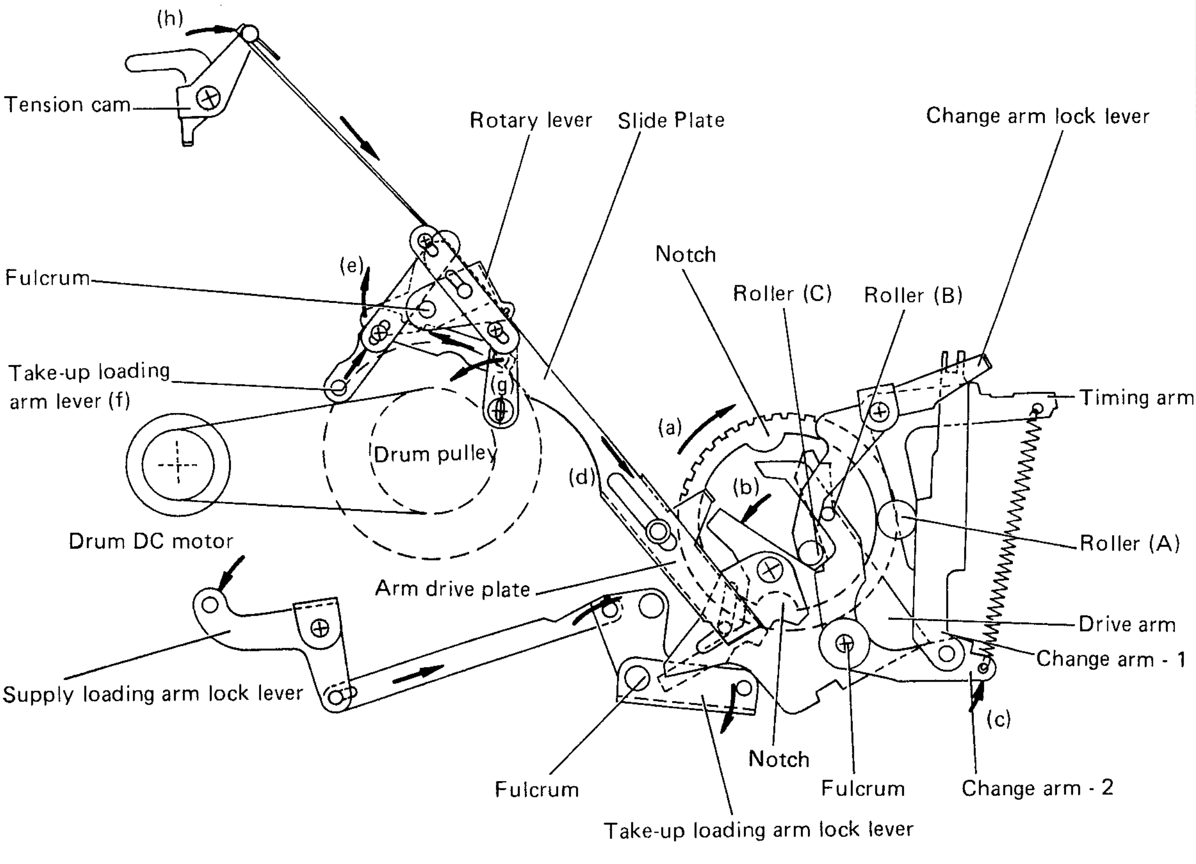

(h)
Tension cam
Rotary lever
Slide Plate
Change arm lock lever
Fulcrum
(e)
Notch
Roller (C)
Roller (B)
Take-up loading arm lever (f)
(g)
Timing arm
(a)
Drum pulley
(d)
(b)
Roller (A)
Drum DC motor
Arm drive plate
Drive arm
Change arm - 1
Supply loading arm lock lever
(c)
Notch
Fulcrum
Fulcrum
Change arm - 2
Take-up loading arm lock lever

Fig. 2-9 Loading-2 mechanism (Bottom view)

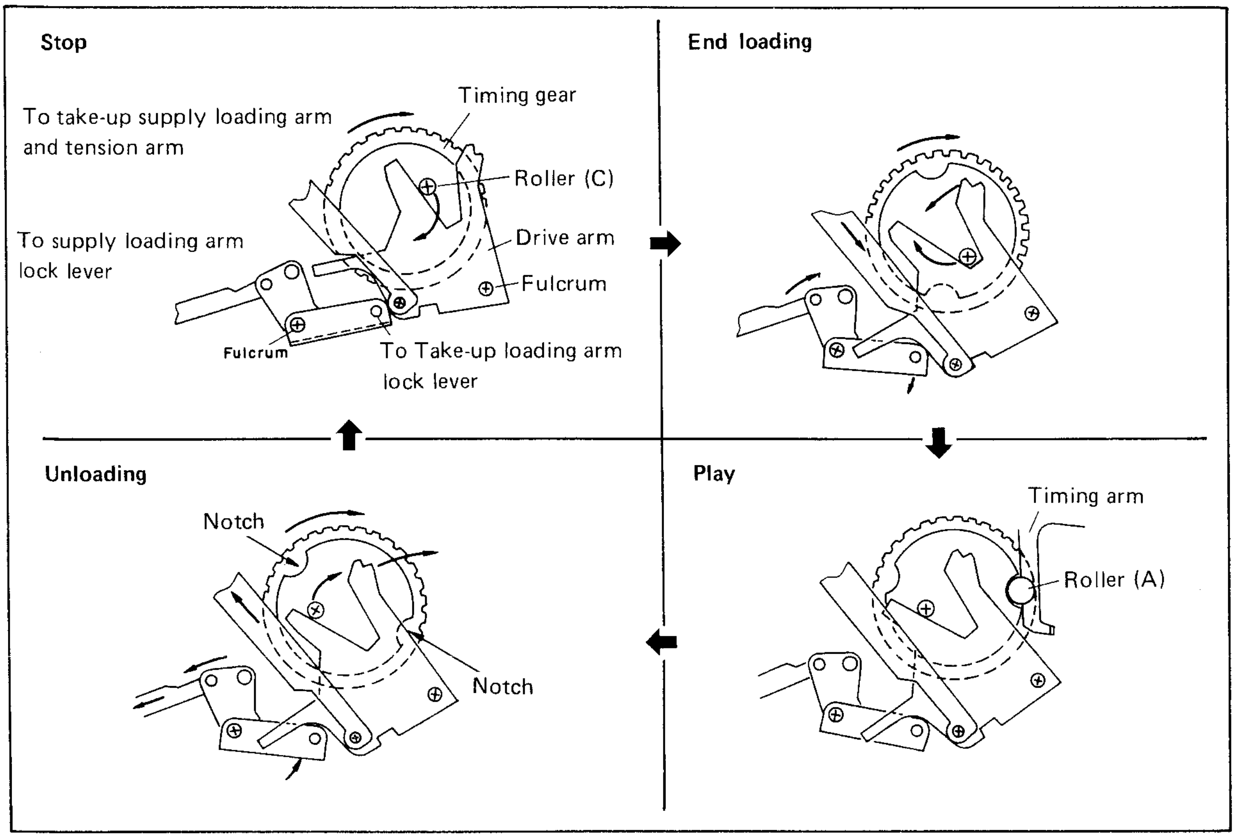

Stop
Timing gear
To take-up supply loading arm and tension arm
Roller (C)
To supply loading arm lock lever
Drive arm
Fulcrum
Fulcrum
To Take-up loading arm lock lever
End loading
Unloading
Notch
Notch
Play
Timing arm
Roller (A)

Fig. 2-10

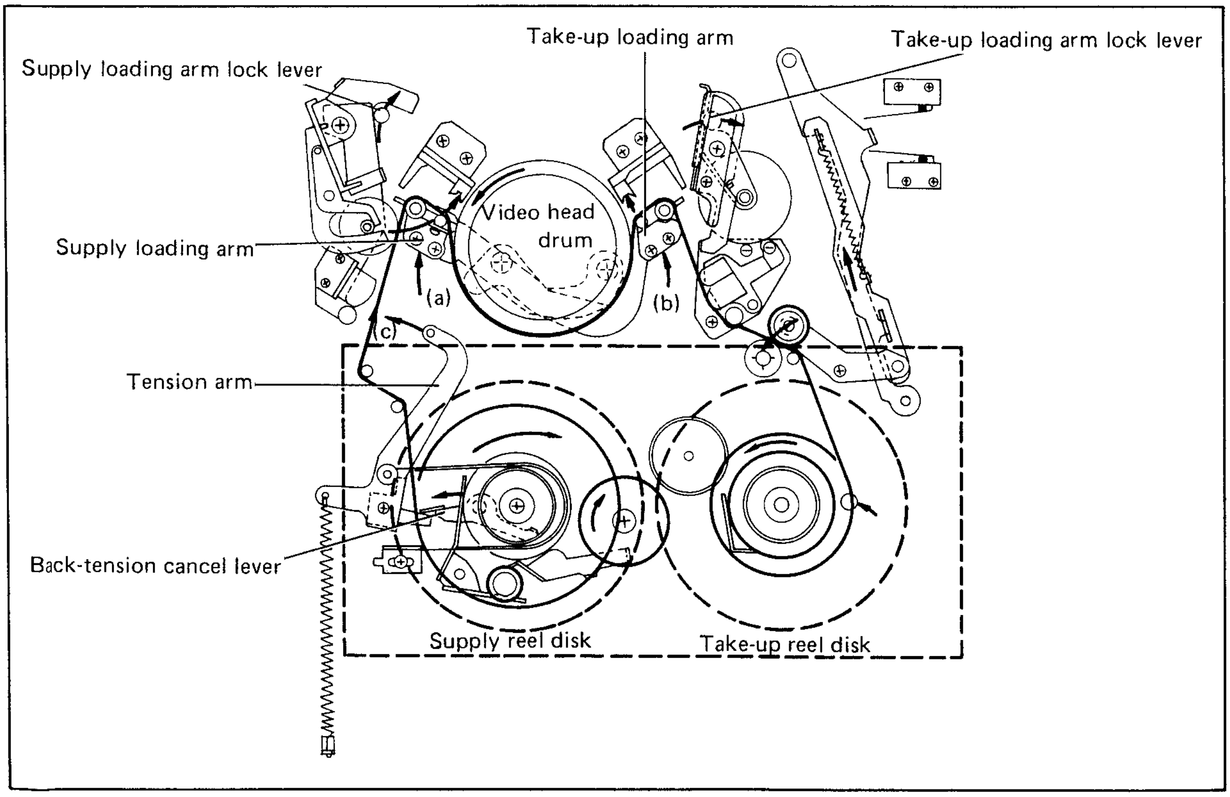

Take-up loading arm
Take-up loading arm lock lever
Supply loading arm lock lever
Video head drum
Supply loading arm
(a)
(b)
(c)
Tension arm
Back-tension cancel lever
Supply reel disk
Take-up reel disk

Fig. 2-11 Loading-2 mechanism (Top view)

2-8 PLAY MODE MECHANISM

Refer to Fig. 2-12 Play mode mechanism (bottom view). By the rotation of the roller (c) on the timing gear, the drive arm moves to arrow (d) and the arm drive plate is pulled to arrow (e).

When the loading arm reaches to the loading end, the movement (d) of the drive arm is effective only to the drive arm plate, and the take-up loading arm lock lever. In this time, the movement of the loading arm stops. On the other hand, by the rotation of the drive arm, the take-up loading arm lock lever turns clockwise (f) to lock the take-up loading arm, and the supply loading arm lock lever turns counterclockwise to lock the supply loading arm. By the rotation of the take-up loading arm lock lever, the pinch slide plate operates and the pinch roller presses to the capstan shaft.

When the drive arm reached to the almost fully counterclockwise position of the drive arm movement by the roller (C) fixed on the timing gear, the stud fixed on the bottom of the timing gear kicks the kick lever counterclockwise (g). Then the kick lever pushes the play lever-3 to arrow (g). As a result, the stud of the change lever will be free from the locking on the upper side of the play lever-3 groove, so that the change lever is ready to move in the direction of arrow (i).

On the other hand, when the drive arm reaches to almost fully counterclockwise position of the drive arm movement, the drive arm lock lever fixed on the change arm lock lever will be free and pulled counterclockwise (h) by the spring. Corresponding to the rotation of the timing gear and the roller (C), the drive arm is locked by the roller (D) of the drive arm lock lever. Then, the roller (A) of the timing arm goes into the notch (E) of the timing gear. By this operation, the change lever becomes free, and starts rotation to arrow (i) by the force of spring.

At this stage, loading is completed and the machine assumes Play mode.

Refer to Fig. 2-13 Play mode mechanism (Top view).

By the movement of the drive arm, the loading arm starts to load. When the loading arm reached to loading end, the take-up arm stopper and the supply arm stopper moves as arrows (a), (b) by the rotation of the drive arm through the take-up loading arm lock lever and the supply loading arm lock lever (bottom side). As the result, the loading arm is locked at the arm stopper. And also, corresponding to movement of the supply arm stopper, the full-erase head and the guide pole are moved to the Play mode position. At this time, tape traveling is determined by the edge of the guide pole.

On the other hand, by the movement of the take-up loading arm lock lever, the pinch roller slide plate-2 con-

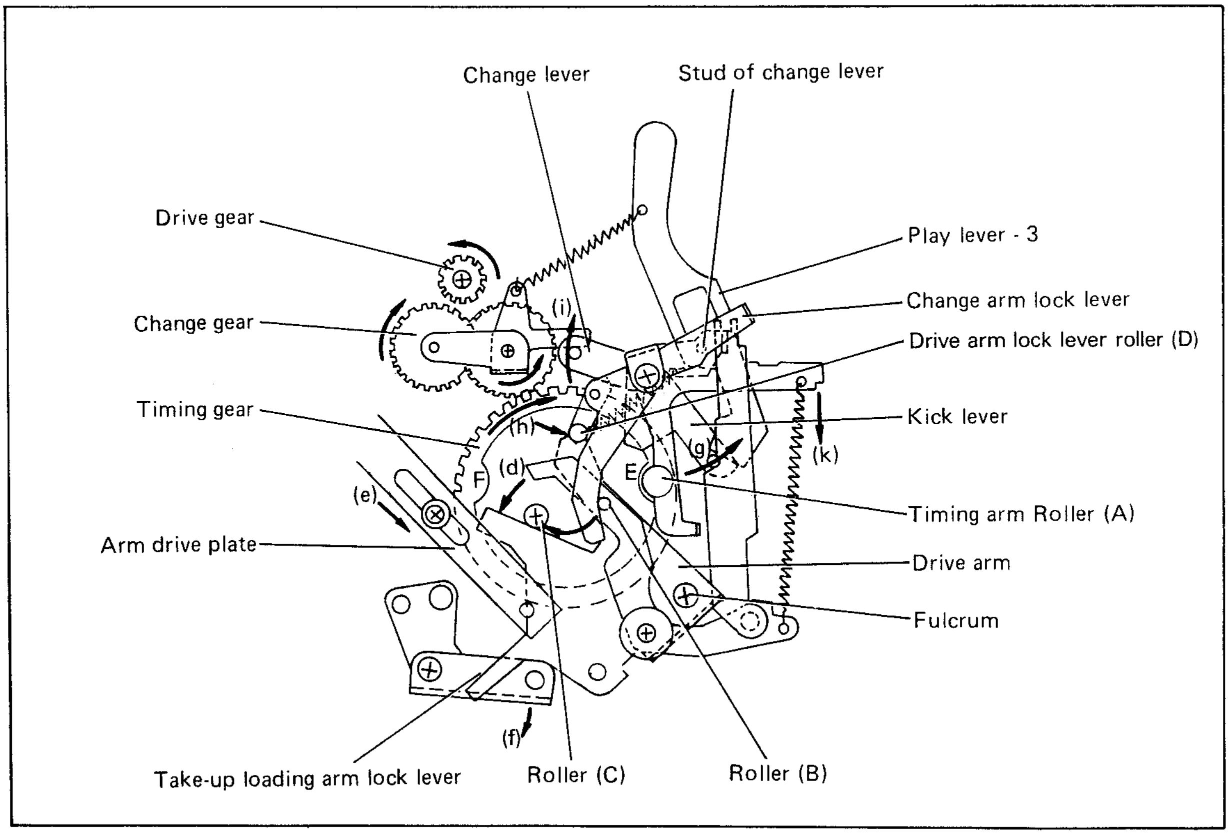


Fig. 2-12 Play mode mechanism (bottom view)

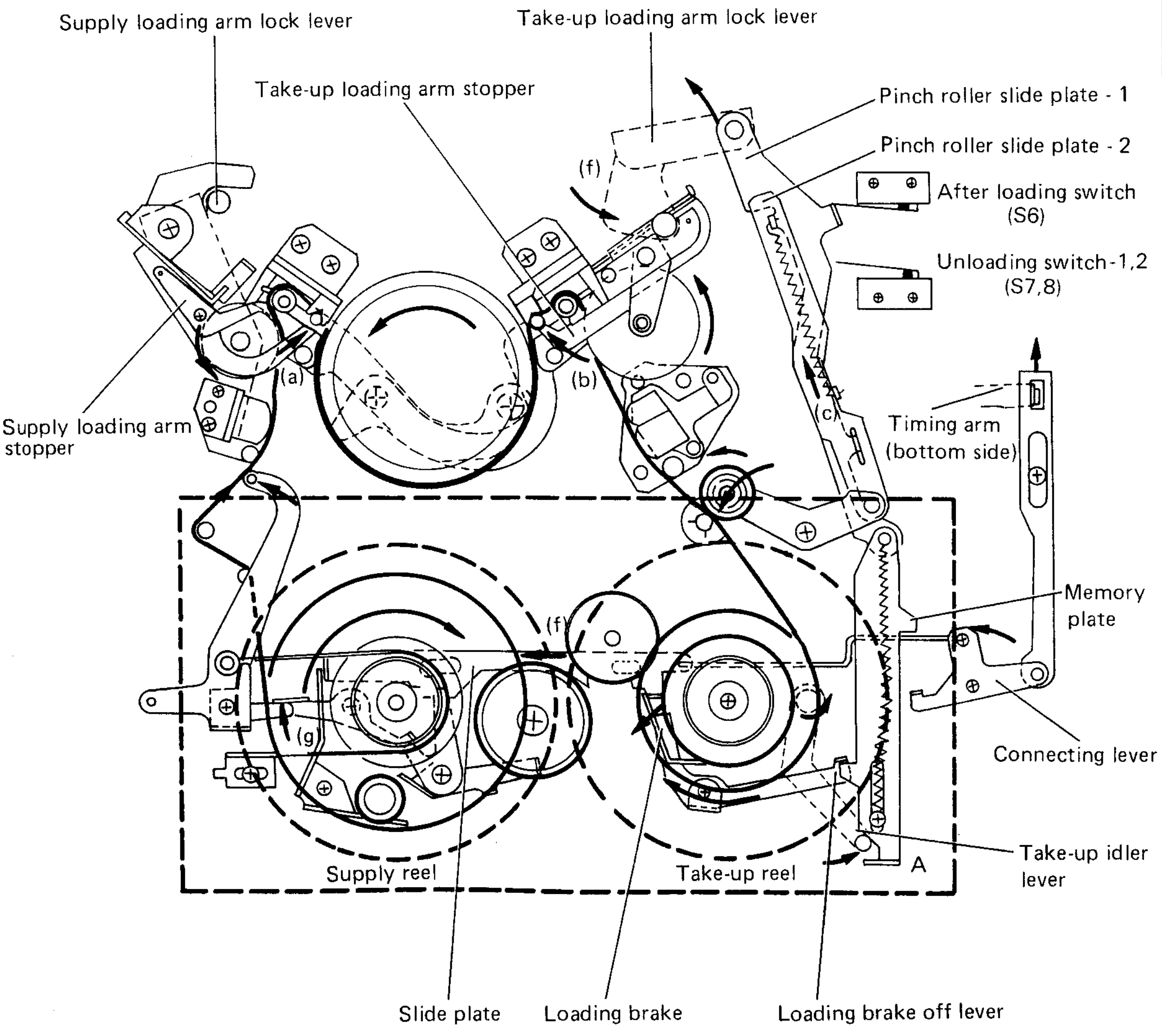
nected with the pinch roller slide plate-1 by the spring is pulled to arrow (c). As a result, the pinch roller is pressed to the capstan shaft. Also, the after-loading switch is turned on by the edge of the pinch roller slide plate-1. In this condition, the tape traveling starts.

At the same time, by the "pulling-up" action of the memory plate with the pinch roller slide lever-1, the take-up idler lever falls into the edge of the memory plate at the point (A) and the take-up idler contacts with the take-up reel disk. At the same time, the loading brake releases from the take-up reel disk by the loading brake off lever.

In other words, the pressing action of the pinch roller and take-up idler and releasing action of the loading brake are separated mostly at the same time. However, the roller (C) of the timing arm (bottom side) has not fallen into the hollow (E) of the timing gear yet up to this time.

When the roller (C) comes into the notch (E) of the timing gear, the change gear is stopped (bottom side). At the same time, the timing arm (bottom side) is moved to arrow (k), and the slide plate moves to arrow (f) by the rotation of the connecting lever through the rod.

By movement of the slide plate to the left, the supply loading brake is released from the supply reel disk and the backtension cancel lever rotates clockwise (g). As a result, the supply backtension becomes effective. After that, the machine will be in Play mode.



Supply loading arm lock lever
Take-up loading arm lock lever
Take-up loading arm stopper
Pinch roller slide plate - 1
Pinch roller slide plate - 2
After loading switch (S6)
Unloading switch-1,2 (S7,8)
(f)
(a)
(b)
(c)
Supply loading arm stopper
Timing arm (bottom side)
Memory plate
(f)
(g)
Connecting lever
Supply reel
Take-up reel
A
Take-up idler lever
Slide plate
Loading brake
Loading brake off lever

Fig. 2-13 Play mode mechanism (Top view)

2-9 UNLOADING MECHANISM (Bottom view)

Refer to Fig. 2-14, Unloading mechanism (Bottom view). When the STOP key is pressed, from the Play mode, the play function mechanism is released from the lock, so that the play lever-1 and -2 which lock the change arm lock lever through the rod is moved to arrow (a) and the change arm lock lever is turned clockwise (a) by the force of spring. Also the drive arm lock lever releases from the drive arm then the drive arm becomes free. When the change arm lock lever turned clockwise, the roller (B) fixed on the change arm becomes free so that the change arm turns counterclockwise (b) by the force of spring. At this time, the other side of the change arm moves to arrow (c), so that the change lever turned to arrow (e). As a result, the change gear is contacted with the drive gear by the rotation of the gear arm. Then, the timing gear rotates clockwise again, and the drive arm turns counterclockwise (f) to original position.

When the roller (A) reached to the notch (E) of the timing gear, the change gear is released from the drive gear by the counterclockwise rotation of the gear arm. At this time, the rotation of the timing gear is stopped.

Refer to Fig. 2-15, Unloading mechanism (Top view).

When pressing the STOP key from the Play mode, the play function mechanism is released. As a result, the unloading idler contacts with the supply reel disk, and the supply reel disk winds up the tape during unloading. At the same time, the take-up brake contacts the take-up reel disk by the movement of the off lever. On the other hand, the supply roller stopper, supply loading arm, take-up roller stopper and take-up loading

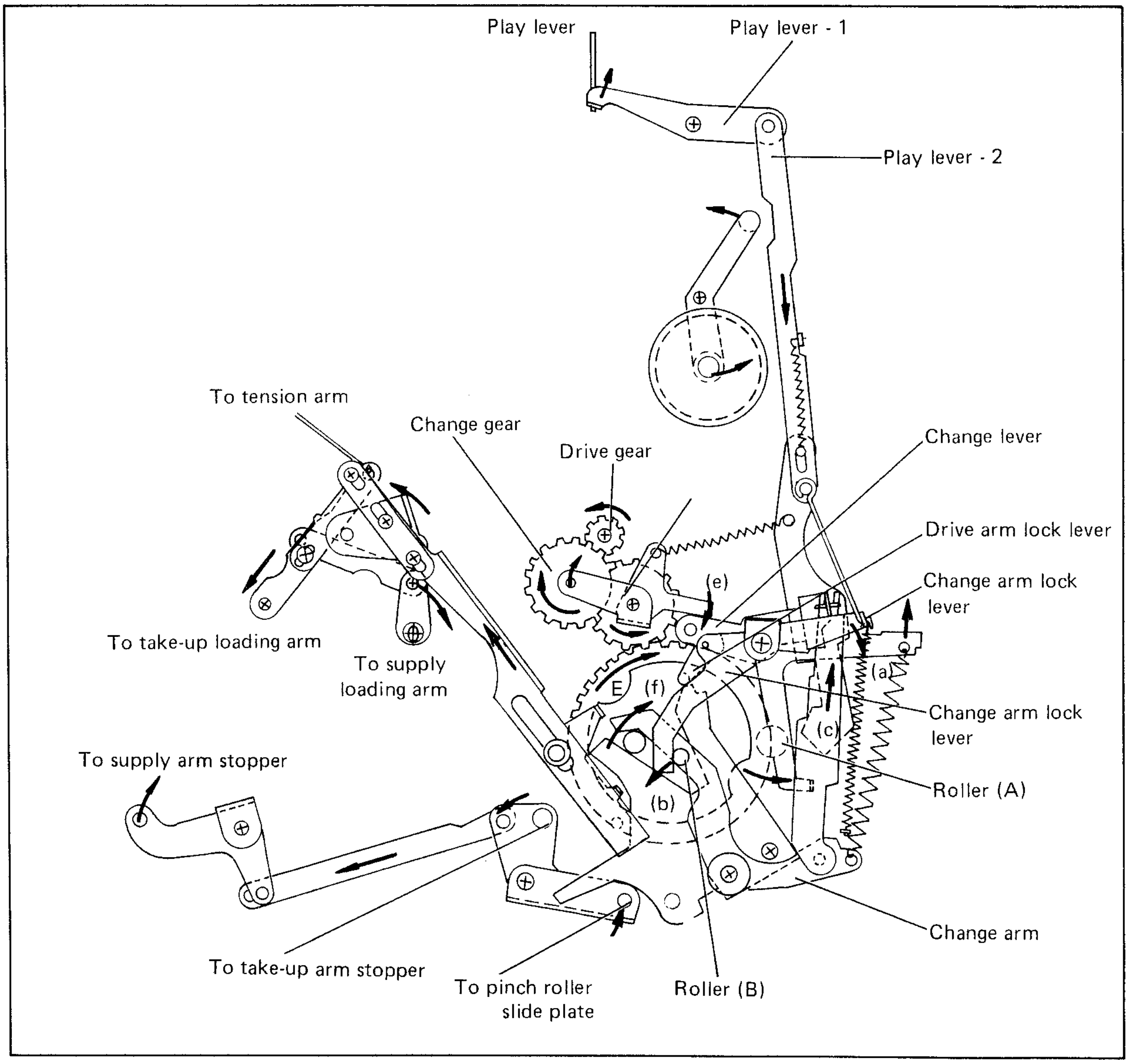

Play lever
Play lever - 1
Play lever - 2
To tension arm
Change gear
Drive gear
Change lever
Drive arm lock lever
(e)
Change arm lock lever
(a)
To take-up loading arm
To supply loading arm
E
(f)
(c)
Change arm lock lever
To supply arm stopper
Roller (A)
(b)
Change arm
To take-up arm stopper
To pinch roller slide plate
Roller (B)

Fig. 2-14 Unloading mechanism (Bottom view)

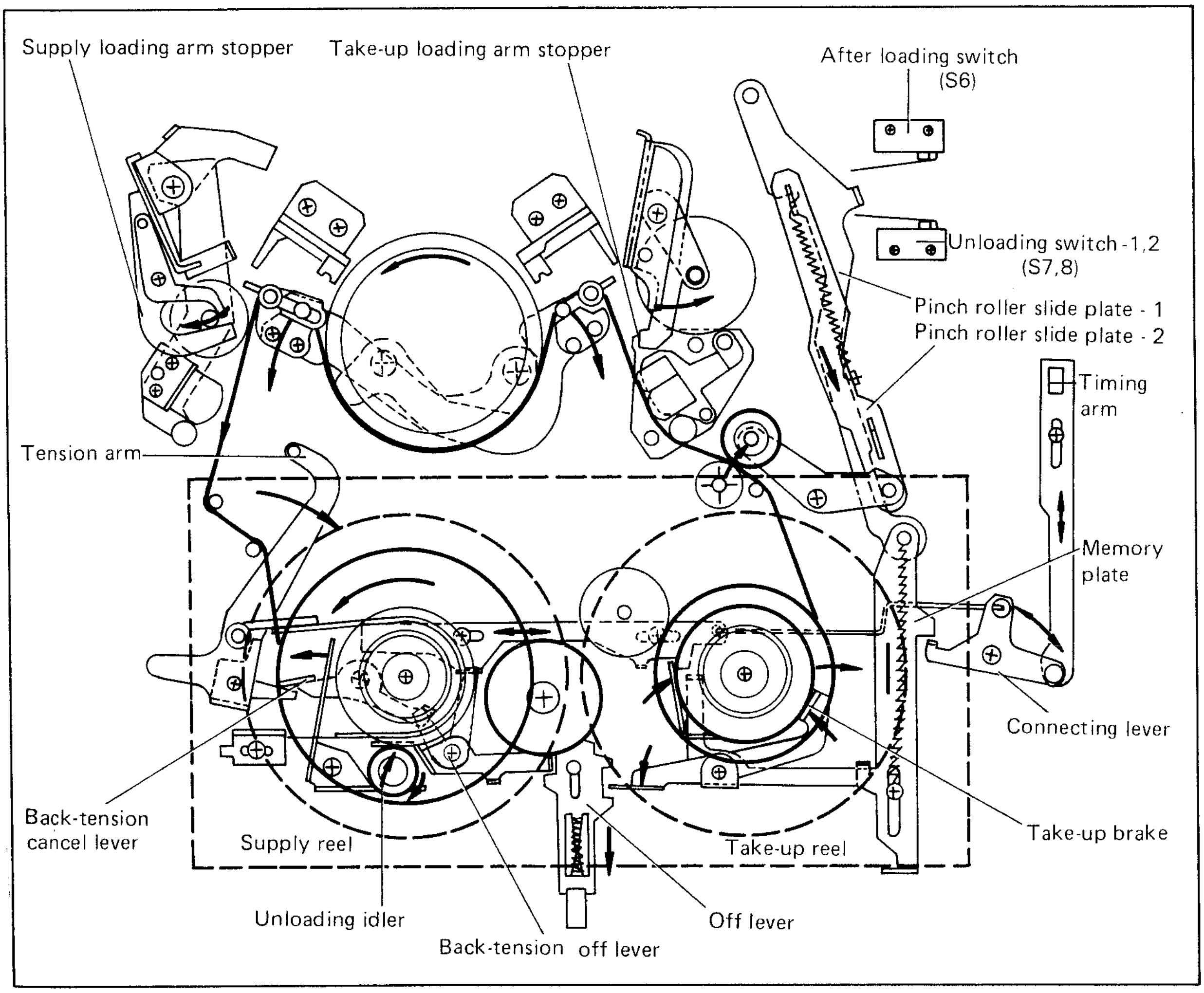

Supply loading arm stopper
Take-up loading arm stopper
After loading switch
(S6)
Unloading switch-1,2
(S7,8)
Pinch roller slide plate - 1
Pinch roller slide plate - 2
Timing
arm
Tension arm
Memory
plate
Connecting lever
Back-tension
cancel lever
Supply reel
Take-up reel
Take-up brake
Unloading idler
Off lever
Back-tension off lever

Fig. 2-15 Unloading mechanism (Top view)

arm are returned to original stop position, however, the roller (A) of the timing gear (bottom side) runs on the edge of the timing gear, the timing arm moves downward so that the slide plate moves clockwise. By the clockwise movement of the slide plate, the backtension cancel lever rotates counterclockwise to release the backtension from the supply reel disk. When the unloading started, the after loading switch is turned off and the after unloading is completed, the unloading switch is turned off then motor rotation is stopped.

2-10 F.F. MODE MECHANISM

When pressing the F.F. key, the unloading idler releases from the supply reel disk and the take-up brake releases from the take-up reel disk by the movement to arrow (a) of the off lever. As a result, the take-up reel disk and the supply reel disk become free.

On the other hand, by pressing up the F.F. lever, the F.F. idler moves to arrow (b) so that the F.F. idler contacts with the rewind idler and the take-up reel disk. As a result, the tape is wound up from the supply reel disk to take-up reel disk.

2-11 REWIND MODE MECHANISM

When the REWIND key is pressed, the unloading idler is released from the supply reel disk and the take-up brake is released from the take-up reel disk by the movement to arrow (a) of the off lever. As a result, the take-up reel disk and the supply reel disk become free.

On the other hand, by "pressing-up" action of the REW lever, the rewind idler contacts with the supply reel disk, so that the tape is wound up from the take-up reel disk to the supply reel disk.

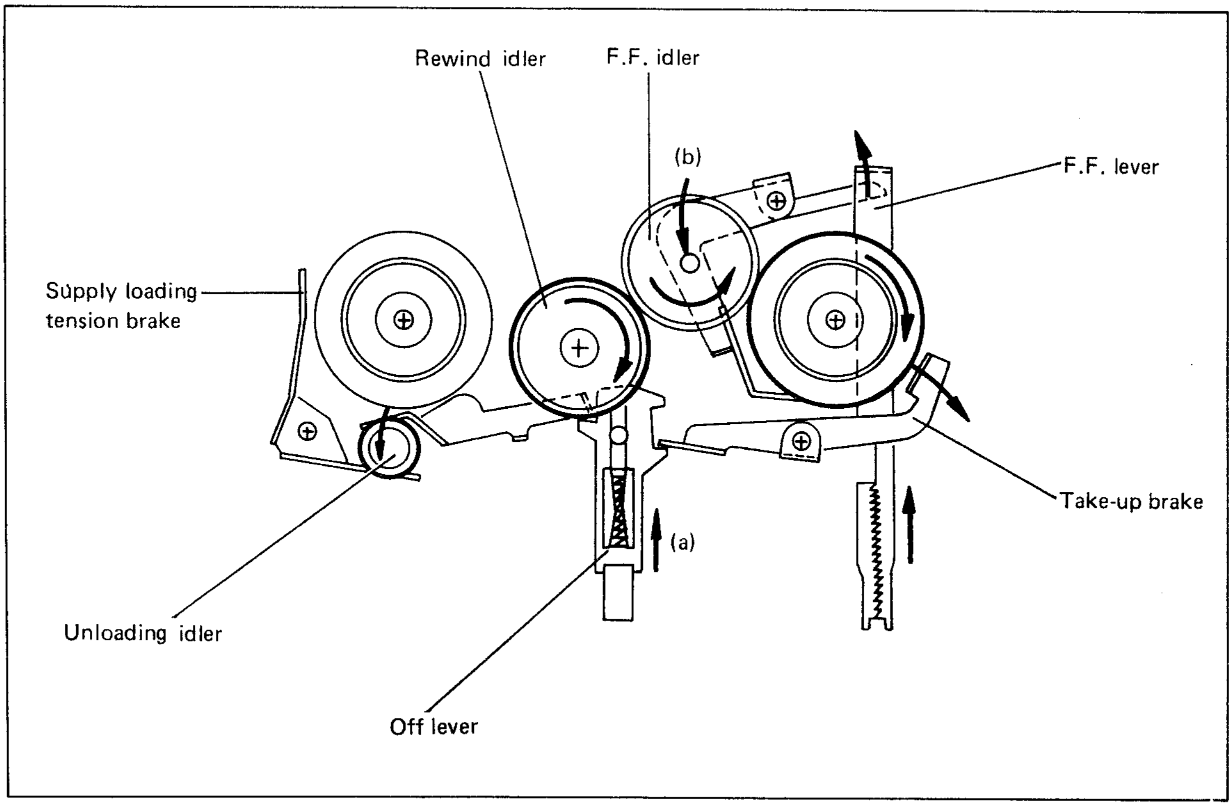

Rewind idler
F.F. idler
(b)
F.F. lever
Supply loading tension brake
Take-up brake
(a)
Unloading idler
Off lever

Fig. 2-16 F.F. mode mechanism

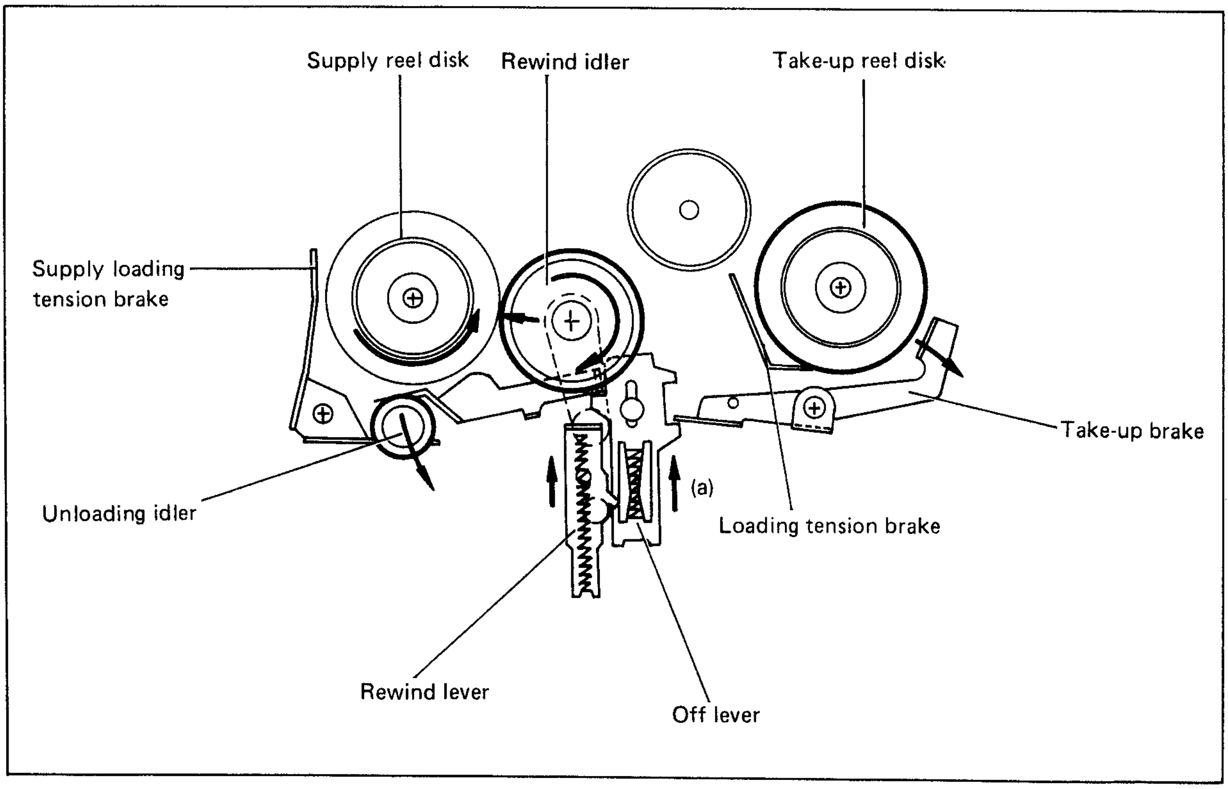

Supply reel disk
Rewind idler
Take-up reel disk
Supply loading tension brake
Take-up brake
(a)
Unloading idler
Loading tension brake
Rewind lever
Off lever

Fig. 2-17 REW mode mechanism

SECTION 3
CIRCUIT DESCRIPTION

3-1 GENERAL

The electronic circuit in the HR-3300E is divided into five major sections; Audio and Servo, Preamplifier and Record amplifier, Mechanism control circuit, Luminance and Color amplifier, and Regulator.
Since the electronic circuitry must be assembled within a limited space in the HR-3300E, a number of IC's are employed; and the circuit design used in common for the recording and the playback circuit makes the best use of the limited space.

3-2 VIDEO SYSTEM

3-2-1 General

In this video cassette recorder, video signals are recorded on a magnetic tape by two rotary video heads. For playback, video signals are re-generated from the magnetic tape through the same video heads. However, it is a general characteristic of magnetic heads that the current generated in playback is proportional to the flux field. Fig. 3-1 illustrates this principle.
The roll-off at higher frequencies is caused by a combination of factors: gap loss (wavelength approaching gap length), tape losses, etc.
For a number of reasons, including the overall bandwidth of the signal, tape limitations and playback characteristics, recording a video signal directly is not feasible. Therefore, the HR-3300E converts the input video signal to an FM signal before recording. It is necessary, of course, to demodulate the FM in playback. In a unit of this size, it is difficult to maintain the time-base stability necessary to permit direct recording of the chroma signal. The effects of this instability are minimized by processing the luminance and chrominance separately. Refer to Fig. 3-2.

The luminance signal is frequency modulated between the limits: 3.8 MHz for sync tip and 4.8 MHz for peak white. The chroma signal is separated from the luminance by a band-pass filter. The subcarrier is then converted from 4.43 MHz to 626.9 kHz, linearly mixed with the FM luminance signal and directly recorded as a sideband of 626.9 kHz. The FM signal also functions as an AC bias for 626.9 kHz colour signal. In playback, those signals are separated by filter networks and processed individually. The FM luminance signal is demodulated, while chroma subcarrier is converted back to 4.43 MHz. Automatic colour correction circuitry minimizes hue and chroma amplitude variations before the signals are recombined. The output signal is PAL-type. An explanation of the block diagram and details of the circuit are as follows. Refer to the overall block diagram and the appropriate schematic diagram in Section 10.

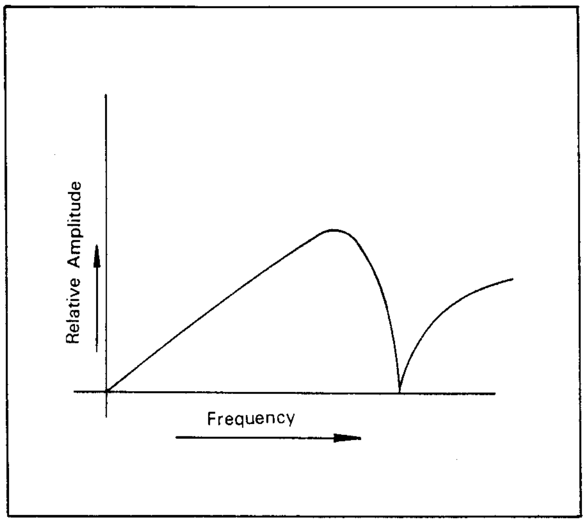
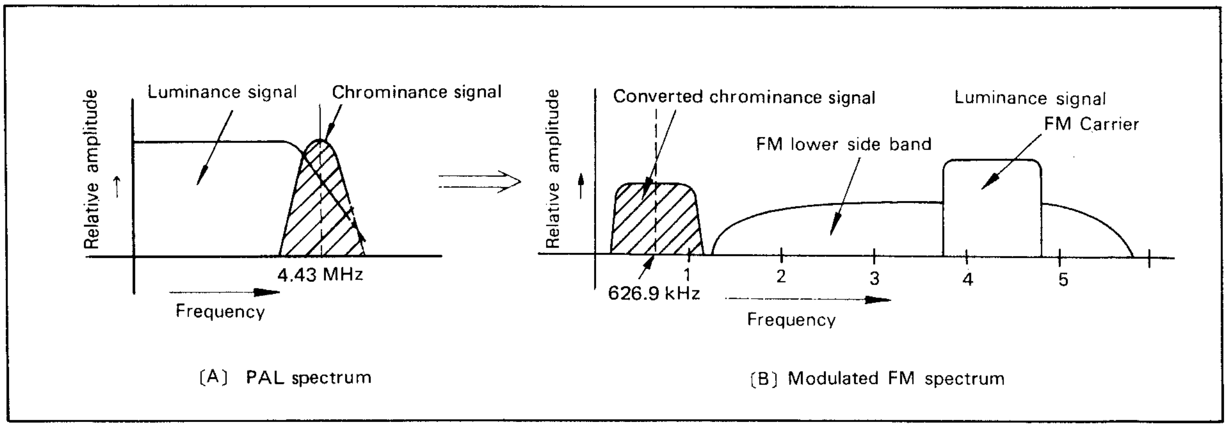


Fig. 3-1 Characteristic response curve for playback head



(A) PAL spectrum

(B) Modulated FM spectrum

Fig. 3-2

3-2-2 Luminance signal recording system

Refer to Fig. 3-3, Block diagram of the luminace signal recording system. The input video signal is kept at a constant level by utilizing an AGC (Automatic Gain Control) circuit, in IC1, so that a constant level may be maintained in spite of fluctuation of input level. This video signal is fed to pin 9 of IC2, AMPLIFIER and SWITCHER. This switcher selects the video signal either record mode or playback mode by PB 12 V DC power supply or REC 12 V DC power supply.

Then video signal is fed to the LPF-1 and LPF-2.

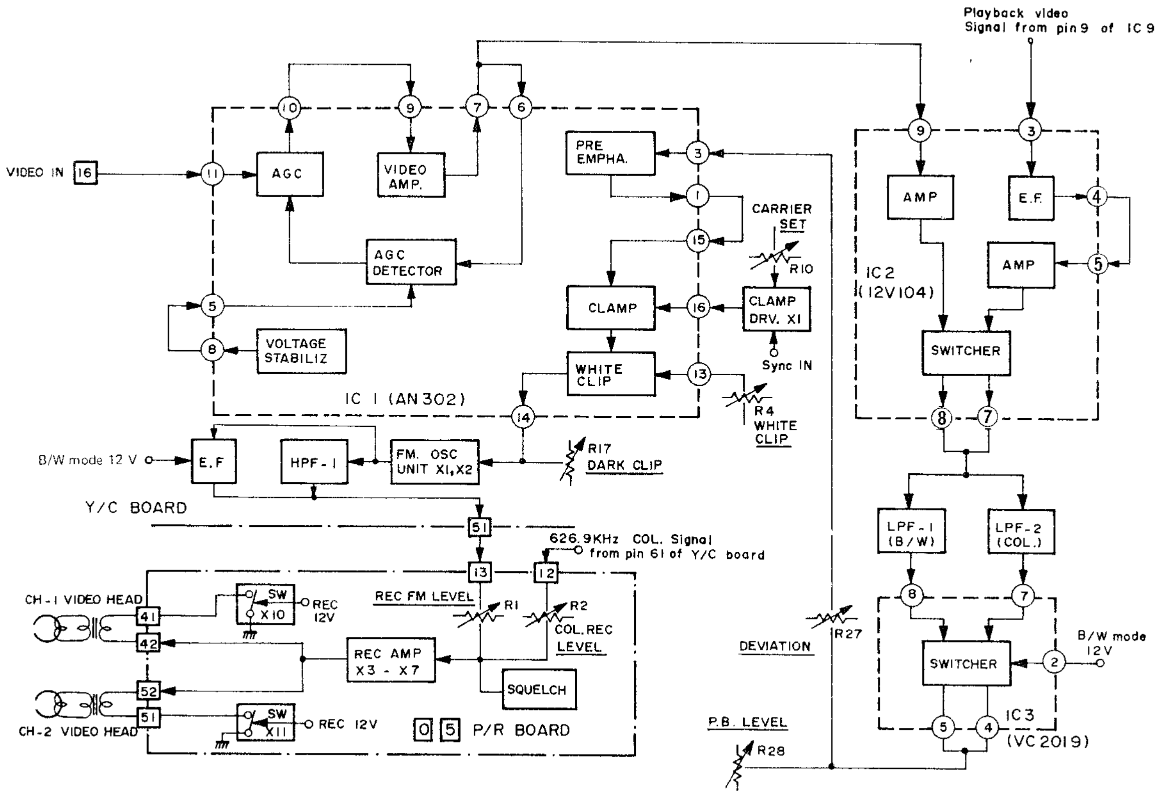
Integrated Circuit IC3 (VC2019) is an electronic switch. It performs change-over of the video signal between colour and black-and-white, controled by the 12 V DC power supply (B/W mode 12 V) to pin 2 of IC3.

In the case of the colour mode, pin 4 and pin 7 of IC3 becomes conductive, so that the signal fed through the LPF-2 (Low Pass Filter-2) which rolls off at 3.38 MHz will pass through the IC3.

However, in the case of the Black-and-white mode, pin 8 and pin 5 of IC3 becomes conductive by B/W mode 12 V DC power supply. So the signal passing through the LPF-1 which rolls-off at 4.1 MHz will pass through SWITCHER of IC3.

After passing through the R27 (DEVIATION), this luminance signal is supplied to pin 3 of IC1 (AN302) PRE-EMPHASIS to improve the signal to noise (S/N) ratio of the video signal. (Pre-emphasis of high frequencies, and later de-emphasis in demodulation, improves the S/N ratio since much noises exist in the high frequencies.)

The pre-emphasized signal is clamped at the sync tip by a clamping circuit, at a level determined by R10 (CARRIER SET) for a 3.8 MHz and peak white level determined by R27 (DEVIATION ADJ) for 4.8 MHz. This is done to prevent drift of the FM carrier caused by variations in the mean DC level of the video signal. The high frequency boost resulted by pre-emphasis causes overshoot in areas of rapid change of signal level.


Playback video Signal from pin 9 of IC 9
VIDEO IN
16
AGC
VIDEO AMP.
AGC DETECTOR
VOLTAGE STABILIZ
PRE EMPHA.
CARRIER SET
R10
CLAMP
CLAMP DRV. X1
Sync IN
WHITE CLIP
R4 WHITE CLIP
IC 1 (AN302)
B/W mode 12 V
E.F
HPF - I
FM. OSC UNIT X1,X2
R17 DARK CLIP
Y/C BOARD
626.9KHz COL. Signal from pin 61 of Y/C board
CH - I VIDEO HEAD
CH-2 VIDEO HEAD
SW X10
REC 12V
SW X11
REC 12V
REC FM LEVEL
R1
R2
COL. REC LEVEL
REC AMP X3 - X7
SQUELCH
P/R BOARD
DEVIATION
R27
P.B. LEVEL
R28
AMP
E.F.
AMP
IC2 (12V104)
SWITCHER
LPF - I (B/W)
LPF-2 (COL.)
SWITCHER
B/W mode 12V
IC3 (VC2019)

KEY TO ABBREVIATIONS:

BPF : Band Pass Filter EMPHA: Emphasis LPF : Low Pass Filter
DRV. : Drive HPF : High Pass Filter MOD. : Modulator
E.F. : Emitter Follower

Fig. 3-3 Block diagram of luminance signal recording system

To prevent overdeviation of the modulator, dark and white clip circuits are used. The output signal of the white clip circuit is fed to the FM modulator, a kind of astable multivibrator.

The modulator was designed to operate at 3.8 MHz at the sync tip and 4.8 MHz at peak-white level.

This modulated FM signal is fed through the high-pass filter (H.P.F.) where all frequencies below approximately 1.4 MHz are eliminated from the spectrum.

After passing through the emitter follower X6, the modulated signal is supplied to the Pre/Record amplifier printed circuit board. Then, at the mixer, this signal is mixed with the converted chroma signal from the colour amplifier. The mixed signal is amplified by the record amplifier and coupled through the rotary transformer to the video head.

1. AGC (Automatic Gain Control), AGC DETECTOR – (IC1, AN302)

The signal from the video input passes through AGC and the Video Amplifier and reaches pin 7 of IC1, which is the AGC output. The signal of AGC output transmitted to the RLC-1, to eliminate the 4.43 MHz colour components, and then supplied to the pin 6 of IC1 which is connected with AGC DET (detector).

The AGC DET (detector) rectifies the video signal from the VIDEO AMP. This DC current is used for a DC bias current of detector.

The AGC is differential type and AGC DET (detector) supplies reference DC current.

2. SWITCHER (IC2), LPF-1, LPF-2, SWITCHER (IC3)

Integrated Circuit IC2 (12V104) is an AMPLIFIER and SWITCHER. It performs change-over of the output video signal of IC2, by PB 12 V DC power supply or REC 12 V DC power supply.

Refer to Fig. 3-4.

In the case of the record mode, the REC 12 V DC power is supplied to pin 11 of IC2, so that the video signal from AGC out (pin 7 of IC1) appears at pin 8 of IC2. In the case of the playback mode, playback video signal

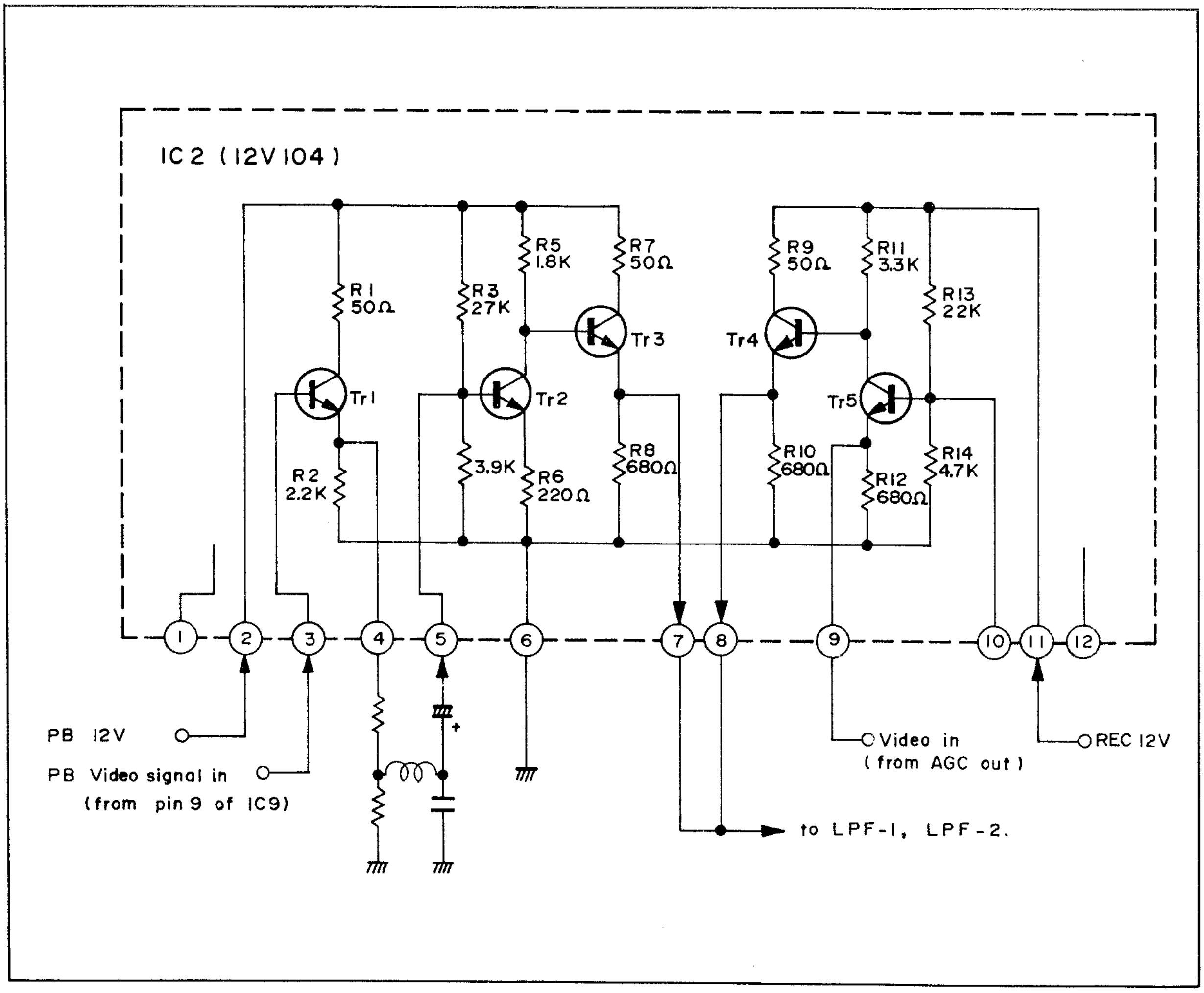

IC2 (12V104)
R1 50Ω
R2 2.2K
R3 27K
3.9K
R5 1.8K
R6 220Ω
R7 50Ω
R8 680Ω
R9 50Ω
R10 680Ω
R11 3.3K
R12 680Ω
R13 22K
R14 4.7K
Tr1
Tr2
Tr3
Tr4
Tr5
1
2
3
4
5
6
7
8
9
10
11
12
+
PB 12V
PB Video signal in
(from pin 9 of IC9)
Video in
(from AGC out)
REC 12V
to LPF-1, LPF-2.

Fig. 3-4

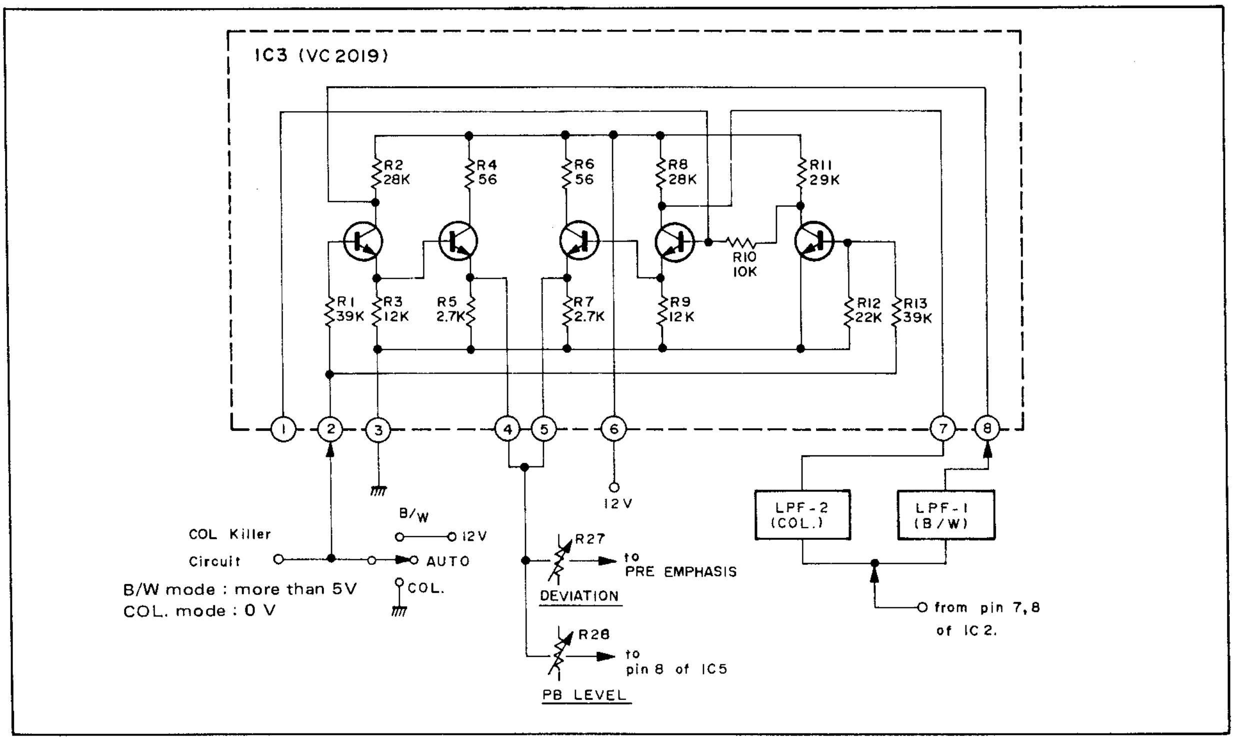

IC3 (VC2019)
R2 28K
R4 56
R6 56
R8 28K
R11 29K
R10 10K
R1 39K
R3 12K
R5 2.7K
R7 2.7K
R9 12K
R12 22K
R13 39K
1
2
3
4
5
6
7
8
12V
LPF-2 (COL.)
LPF-1 (B/W)
COL Killer Circuit
B/W
12V
AUTO
COL.
B/W mode : more than 5V
COL. mode : 0 V
R27
to PRE EMPHASIS
DEVIATION
R28
to pin 8 of IC5
PB LEVEL
from pin 7, 8 of IC 2.

Fig. 3-5

from pin 9 of IC9 is fed to pin 3 of IC2 and PB 12 V power is supplied to pin 2 of IC2, so that the video signal appears at pin 7 of IC2.

Refer to Fig. 3-5, SWITCHER.

After passing through the SWITCHER (IC2), the video signal is supplied to LPF1, LPF-2 and SWITCHER (IC3). Characteristics of LPF-1, LPF-2 are shown in Fig. 3-6.

Integrated Circuit IC3 (VC2019) is an electronic switch. It performs change-over of the video signal between colour and black-and-white, controlled by MODE SW or colour killer circuit. In the case of the colour mode, pin 2 of IC3 is grounded potential so that the video signal coming from pin 7 or 8 of IC2 is first supplied to LPF-2 (Low-Pass-Filter-2) which rolls off at 3.3 MHz will pass through the SWITCHER of IC3.

Also, LPF-2 has 0.9 μs delaying function for adjusting the timing of colour signal and luminance signal. Then, this video signal is supplied to R27 (DEVIATION) at the record mode and R28 (PB LEVEL) at the playback mode. In the case of the black-and-white mode, pin 2 of IC3 is charged with the Black-and-White mode 12 V DC power supply, so that the video signal from pin 7 or 8 of IC2 fed through LPF-1 which rolls off at 4.1 MHz will pass through the SWITCHER of IC3.

Then, this video signal is supplied to R27 (DEVIATION) at the record mode and R28 (PB LEVEL) at the playback mode.

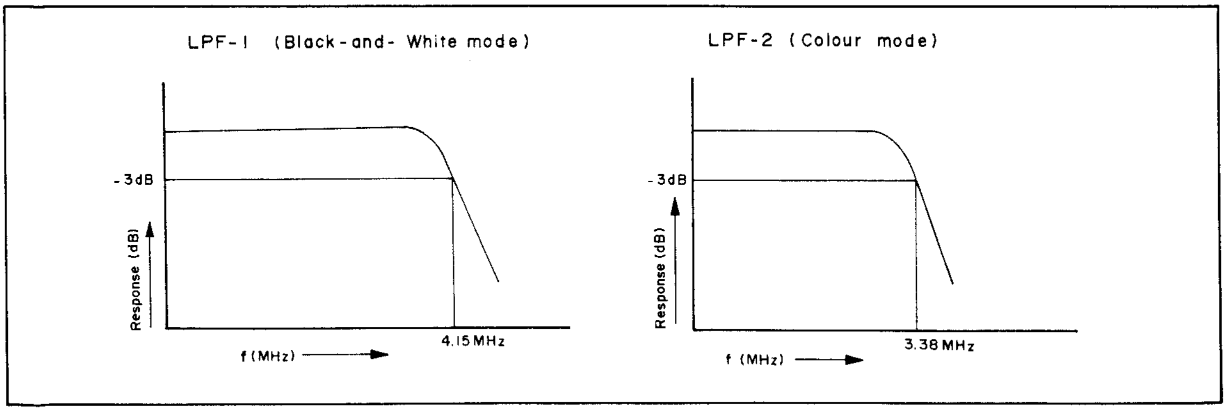


Fig. 3-6 Characteristic of LPF-1 and LPF-2

3. PRE-EMPHASIS – IC1, AN302

The video signal which has just passed through LPF-1 or LPF-2 is adjusted in level at the deviation adjuster, (R27) then is supplied to the Pre-emphasis circuit which improves the signal-to-noise (S/N) ratio of the video signal. In general, FM modulated signals are influenced in amplitude and phase by noise. And also, the higher the frequency is, the more it is affected and has S/N deterioration upon demodulation.

Pre-emphasis of this model functions more strongly than that of conventional 3/4"-VCRs. For, this model requires much more consideration on S/N ratio than for conventional ones because of its unique high density recording system.

Pre-emphasis is decided by the frequency charateristic of the feedback loop from pin 1 of IC1 to pin 2 of IC1.

4. CLAMP, WHITE CLIP and DARK CLIP

The pre-emphasized video signal is supplied to pin 15 of IC1, CLAMP, which makes the sync tip hold constant potential accurately so that sync tip may be at 3.8 MHz upon FM modulation.

The pre-emphasis or high frequency boost causes overshoot or undershoot, it is difficult to clamp the signal at sync tip. Therefore, exact sync tip clamping is made by switching circuit X1 (Clamp Drive).

To prevent over-deviation of the modulator, dark and white clip circuit are used. Dark clip is set by R17 (DARK CLIP) and the setting of R4 (WHITE CLIP) determines white clip level.

The signal treated as above is supplied to FM modulator.

Reference: In the case of overmodulation there frequently occurs AM phenomenon in the modulated wave, which causes reverse of black and white and deterioration of S/N ratio.

4. FM MODULATOR

The video signal from the White and Dark Clippers is supplied to FM MODULATOR. The FM modulator is a kind of unstable multivibrator with input voltage determined by the video signal.

The oscillation frequency of the FM modulator is shown by the following formula:

$$f = \frac{1}{2CR \log_e \left(1 + \frac{E_o}{E_{in}}\right)}$$

f is frequency in cycles per second (Hertz).

E_{in} is input signal voltage.

RC is the time constant of base charging circuit.

E_o is power supply voltage.

The modulator was designed to operate at 3.8 MHz at the sync tip and 4.8 MHz at the white peak as shown in Fig. 3-7.

The FM modulator is unified and there are feed-through type capacitors (signal part: 22 pF, power source part: 1000 pF) at the input and output terminals. Which prevent the signal from breaking out of the FM modulator.

D3 and D4 are temperature compensating diodes.

Then the FM-modulated signal is supplied to HPF (High Pass Filter).

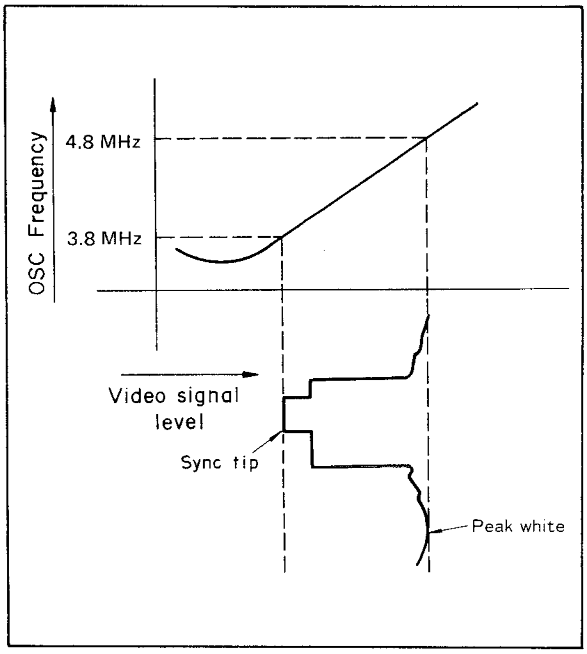


Fig. 3-7 Video to FM transfer characteristics

6. HPF-1 (High Pass Filter)

HPF (High Pass Filter) functions in attenuating the part which lower side bands of FM frequencies generated by FM modulation fall on lower band of converted colour signal. The modulator output is coupled across a high pass filter which eliminates the part (all signals in the spectrum below approximately 1.4 MHz) which are lower than sidebands of FM modulation.

The FM signal that passed through HPF is supplied to ;X6 (Emitter Follower) which makes the signal low impedance and sends it to the Preamplifier/Record amplifier circuit board.

7. REC AMP (Recording Amplifier), SQUELCH

The FM modulated signal is supplied to Preamplifier and Recording amplifier circuit from X6,X7of Luminance and colour amplifier circuit, then mixed with the converted chroma signal (626.9 kHz) at the Preamplifier and Record amplifier circuit. Transistors X1 and X2 in the Record amplifier constitute a squelch circuit controlled by After Loading (AL)12 V power supply.

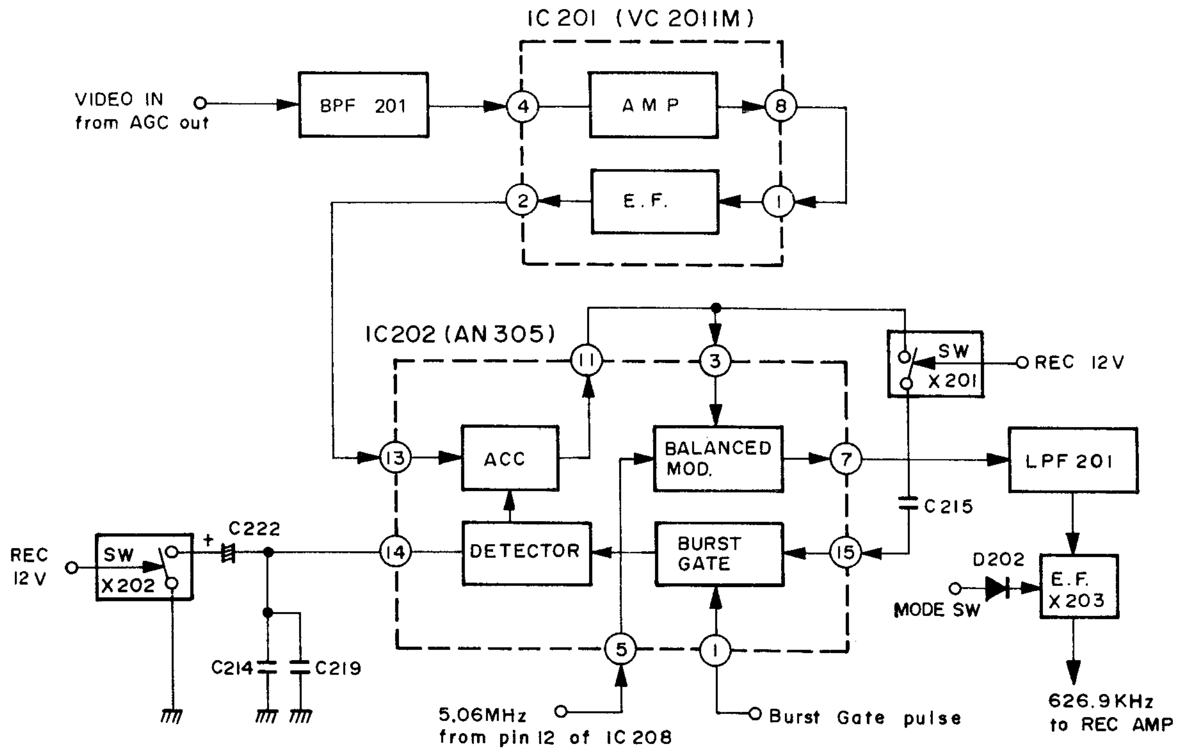
The FM modulated signal is not supplied to recording amplifier for about 3 s after loading is completed, by the squelch circuit. This avoids mis-erasing of recorded signal, which is apt to happen when a tape travelling is not completed.

3-2-3 Colour signal recording system

Refer to Fig. 3-8.
The chroma signal is separated from the video signal by the band-pass-filter (BPF-201). This chroma signal is amplified by IC201, supplied to emitter follower (EF) which provides a low impedance drive, then supplies to ACC (Automatic Color Control) circuit. The output ACC (Automatic Color Control) is kept at a constant level, then supplied to the balanced modulator. At the balanced modulator the subcarrier is converted by mixing the colour signal of 4.43 MHz and 5.06 MHz.
The output of the balanced modulator is the sum and difference frequencies of both input signals. They are fed to the LPF and only the difference frequency (626.9 kHz) is pressed. Then the chroma signal is mixed with the luminance signal at the recording amplifier, and fed to the video head.

1. BPF-201 (Band-pass-filter), AMPLIFIER, EF (Emitter Follower)

The video signal from pin 7 of IC1 (AGC output) is supplied to band-pass-filter (BPF-201). See Fig. 3-9. The band-pass-filter eliminates any residual luminance component in the signal and allows only the 4.43 MHz subcarrier and 500 kHz modulation to be passed to pin 4 of IC201 (amplifier).
Refer to Fig. 3-8.
The output of the amplifier, pin 8 of IC7, is connected. After passing through the emitter follower, the chroma signal is supplied to pin 13 of IC202, ACC (Automatic Color Control) circuit.


IC 201 (VC 2011M)
VIDEO IN
from AGC out
BPF 201
4
A M P
8
2
E. F.
1
IC202 (AN 305)
11
3
SW
X 201
REC 12 V
13
ACC
BALANCED MOD.
7
LPF 201
C 215
REC
12 V
SW
X 202
+
C222
14
DETECTOR
BURST GATE
15
D202
MODE SW
E. F.
X 203
C214
C219
5
1
5.06MHz
from pin 12 of IC 208
Burst Gate pulse
626.9KHz
to REC AMP

KEY TO ABBREVIATIONS:
ACC : Automatic Colour Control
BPF : Band Pass Filter
E.F. : Emitter Follower
LPF : Low Pass Filter
SW : Electronic Switch

Fig. 3-8 Block diagram of colour signal recording system

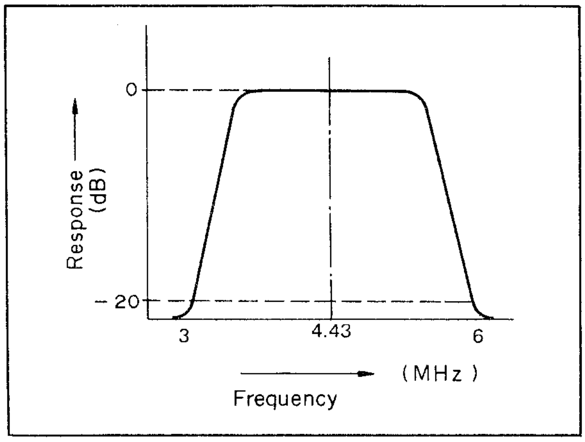


Fig. 3-9 Characteristic of BPF-201

2. ACC, ACC DETECTOR-IC202 (AN305)
Refer to Fig. 3-8.
This ACC is peak-type and maintains the level of the 4.43 MHz colour signal constant in record mode and the playback mode. In the record mode colour signal from pin 11 of IC202 (ACC output) is supplied to pin 15 of IC202 BURST GATE through C215 because X201 (SW) is tured on by the REC 12 V DC power supply. At the same time, the burst gate signal is supplied to the pin 1 of IC202, so that the burst signal is separated at the BURST GATE and then, this signal is supplied to the ACC detector (DETECTOR).
At the ACC detector (DETECTOR), the peak level of the burst signal is picked out and rectified to DC voltage change as a control voltage. That is a burst level change is detected as a DC component change so that the ACC output is automatically controlled at the constant level.
In recording mode, transistor X202 turns on, so that the pin 14 of IC202 connected with C217, C219 and C207. That is a time constant of ACC detector.
In playback mode, the chroma signal from pin 1 of IC203 is supplied to pin 15 of IC202, and the burst pulse is supplied to pin 1 of IC202. The burst signal is picked out at the GATE, and sent to the detector (DET.).
At the detector, the burst level change from the burst gate is detected as a DC component change, and sent to the ACC as a control voltage. Also, transistor X202 is turned off so that the time constant of detector is determined by C219 and C217.

3. BALANCED MODULATOR (IC202) -- LPF-201, E.F.
Integrated circuit IC202 is a frequency converter; the 4.43 MHz subcarrier is fed to pin 3 of IC202 from ACC circuit and the 5.06 MHz CW is fed to pin 5 of IC202. As a result, both sum and difference frequencies will be seen in pin 7 of IC8 as shown in Fig. 3-10.

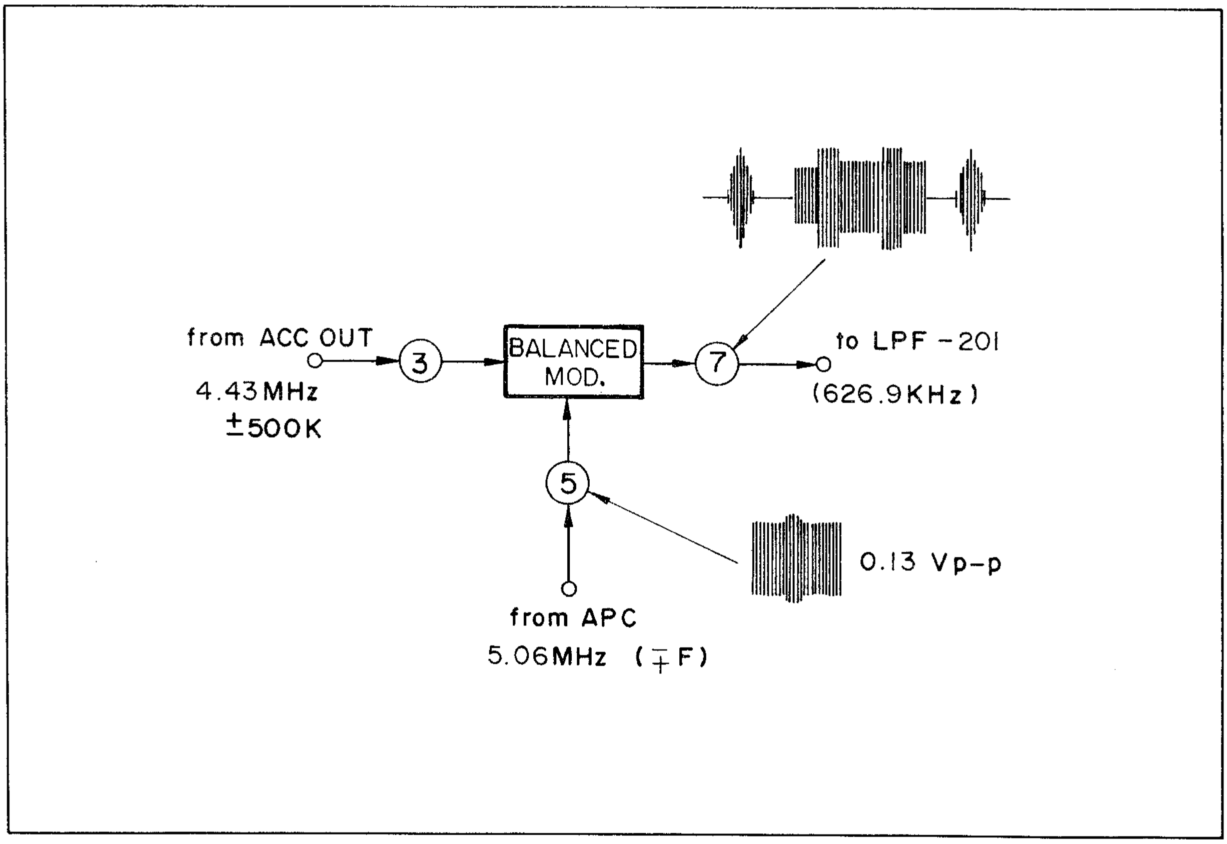


Fig. 3-10 Main converter

Sum frequencies component ... 9.49 MHz ± 500 kHz
Difference frequencies component .... 626.9 kHz ± 500 kHz

Both signals 9.49 MHz and 626.9 kHz, are presented at the input of LPF-201 (Low-Pass Filter) which rolls off at approximately 1.5 MHz. This means that only the 626.9 kHz is obtained at the output of LPF-201.

In the HR-3300E the phase-shift-colour recording system has been adopted, which rotates phase of the colour signal -90° every 1-H for CH-2 video head at the recording, so that the 5.06 MHz signal from APC is as follows:

5.06 MHz ± F (F : phase rotation)

Therefore the converted frequency is:

$(5.06\ \text{MHz} \pm F) - (4.43\ \text{MHz} \pm 500\ \text{kHz})$
$= 626.9\ \text{kHz} \pm F \mp 500\ \text{kHz}.$

According to the above, it will be clear that the phase of low frequency converted chroma signal is rotated -90° for CH-2.

The output signal of LPF-201 is sent to the emitter follower (X203), then sent to the pre-amplifier and record amplifier board.

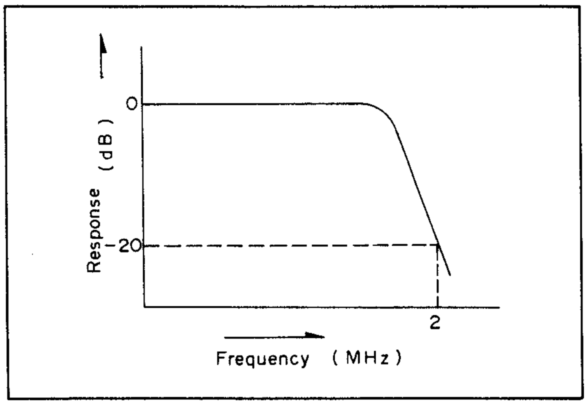
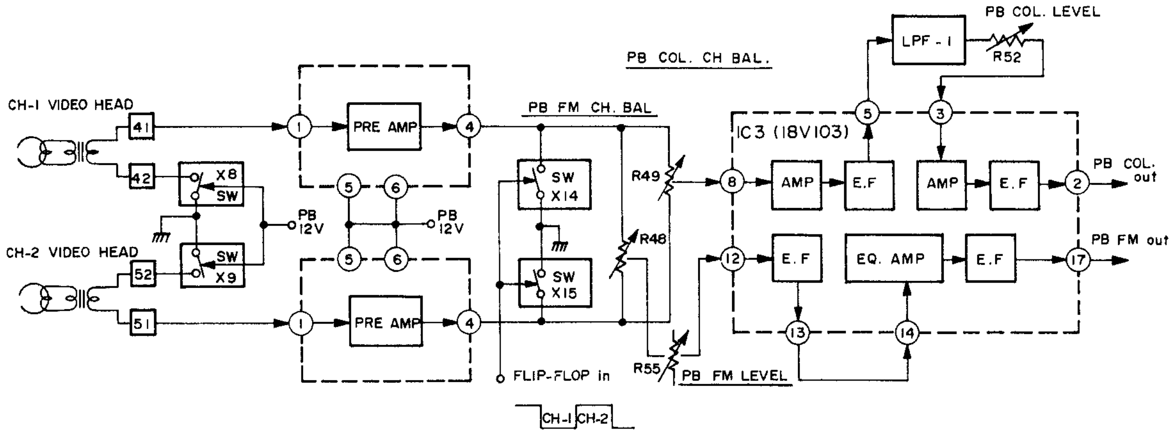


Fig. 3-11 Characteristic of LPF-201

3-2-4 Luminance and colour signal playback system

Refer to Fig. 3-12.

During playback the regenerated FM signal from both video heads is amplified by the preamplifier, IC1 and IC2 (PRE/REC board) of CH-1 and CH-2. The preamplifiers are switched by a symmetrical square-wave


CH-1 VIDEO HEAD
41
42
X8
SW
CH-2 VIDEO HEAD
SW
X9
52
51
PB 12V
1
PRE AMP
4
5
6
PB 12V
5
6
1
PRE AMP
4
PB FM CH. BAL
SW X14
SW X15
FLIP-FLOP in
CH-1
CH-2
PB COL. CH BAL.
R49
R48
R55
PB FM LEVEL
LPF - 1
PB COL. LEVEL
R52
IC3 (18V103)
5
3
8
AMP
E.F
AMP
E.F
2
PB COL. out
12
E.F
EQ. AMP
E.F
17
PB FM out
13
14

KEY TO ABBREVIATIONS:
COL. : Colour
EQ. : Equalizer
LPF : Low Pass Filter
SW : Electronic Switch

Fig. 3-12 Block diagram of luminance and colour signal playback system-1

generated by two fixed magnets on the rotary head drum assembly. This switching permits the two FM signals to be combined. The output of the FM switching (SW) is sent to the luminance equalizer (IC3), then sent to the luminance demodulator circuit on the luminance/colour circuit board.

On the other hand, the chroma signal is supplied to the LPF-1 (low-pass filter) after passing through the colour amplifier IC3. Only the 626.9 ± 500 kHz chroma signal passes through the LPF-1. After the colour signal level determined by R52 (P.B. COL. LEVEL). This signal is amplified by colour amplifier IC3, then sent to the luminance/colour circuit board.

1. PRE-AMPLIFIER

The playback signal obtained from a tape is approximately 1—2 mV in amplitude. This very low amplitude requires the circuit used as a preamplifier to be the high gain, low noise variety.

The signal is coupled across a rotary transformer to pin 1 of IC1. Capacitors C16 and C18 are adjusted to match the impedance of the video heads to the input circuit. Integrated circuits IC1 and IC2 constitute a pre-amplifier with cascade configuration which provides the high gain, low noise characteristic necessary. Figure 3-13 shows the overall response characteristics of the preamplifier.

The output from then are fed to the switcher X14, X15.

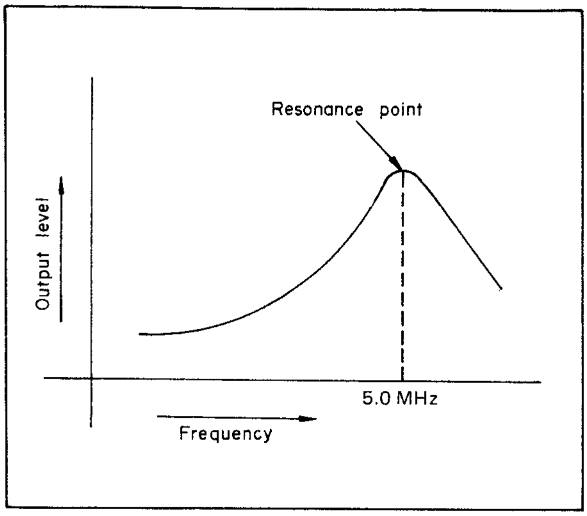


Fig. 3-13 Frequency response of the pre-amplifier

2. SWITCHES (SW) X14 and X15

The VHS is a two-head helical scan machine. During record, each head is actually in contact with the tape for more than 180°, so each recorded video track is longer than one field. In playback it is necessary to switch from one head to the other, without mixing the FM signals.

Playback switching is illustrated in Figure 3-14.

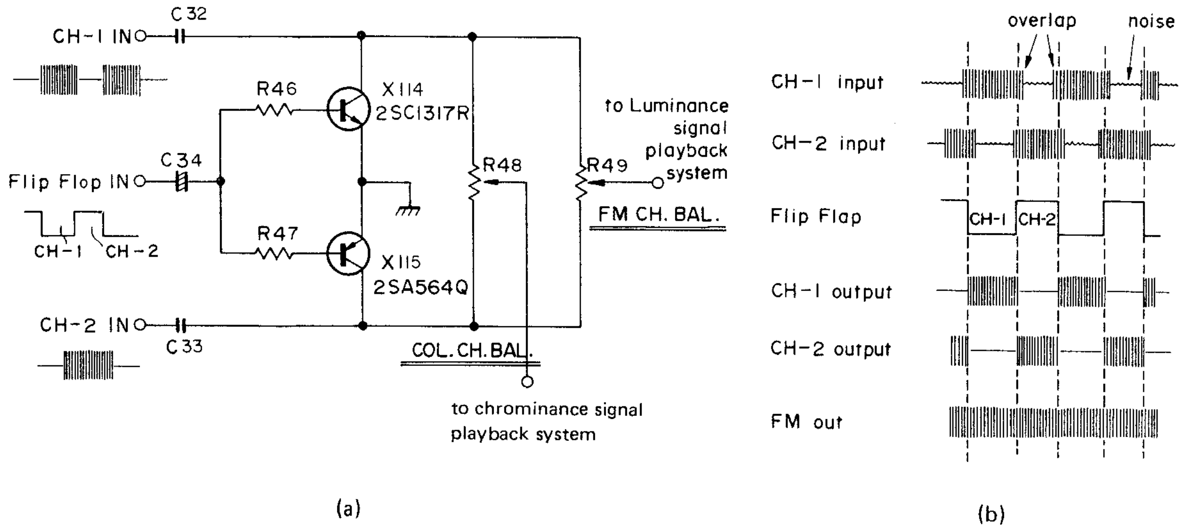

C32
CH-I IN
R46
X114
2SC1317R
C34
Flip Flop IN
CH-1
CH-2
R47
X115
2SA564Q
CH-2 IN
C33
R48
R49
to Luminance signal playback system
FM CH. BAL.
COL. CH. BAL.
to chrominance signal playback system
(a)
overlap
noise
CH-I input
CH-2 input
Flip Flop
CH-I
CH-2
CH-I output
CH-2 output
FM out
(b)

Fig. 3-14 FM switching system

A signal is applied from CH-1 and CH-2 with every rotation of the video heads. Since mixing two FM signals presents may difficulties, a continuous signal is formed by the switching method.

The tape wrap in the drum is slightly more than 180° so there is a little overlap on the playback signal. Switching is accomplished as follows: Approximately 5-H before the leading edge of vertical sync, one channel has almost completed its signal path and the other is just beginning.

At this time 25-cycle square waves change polarity on the bases of the X14 and X15. When a positive part of gate pulse is applied to the base of X14, transistor X14 is turned on and shorts any signal on the collector to ground. However, transistor X15 is turned off by this positive gate pulse and any signal at the collector is passed to the resistive mixing network.

4. COLOUR AMP (IC3), LPF-1

After passing through the R49 and R55 (PB FM LEVEL),(COLOUR CHANNEL BALANCE) the playback chroma signal is amplified by the Colour Amp (IC3), then sent to LPF-1 (Low-Pass-Filter).

The low-pass-filter eliminates all signals in the spectrum above approximately 1.5 MHz.

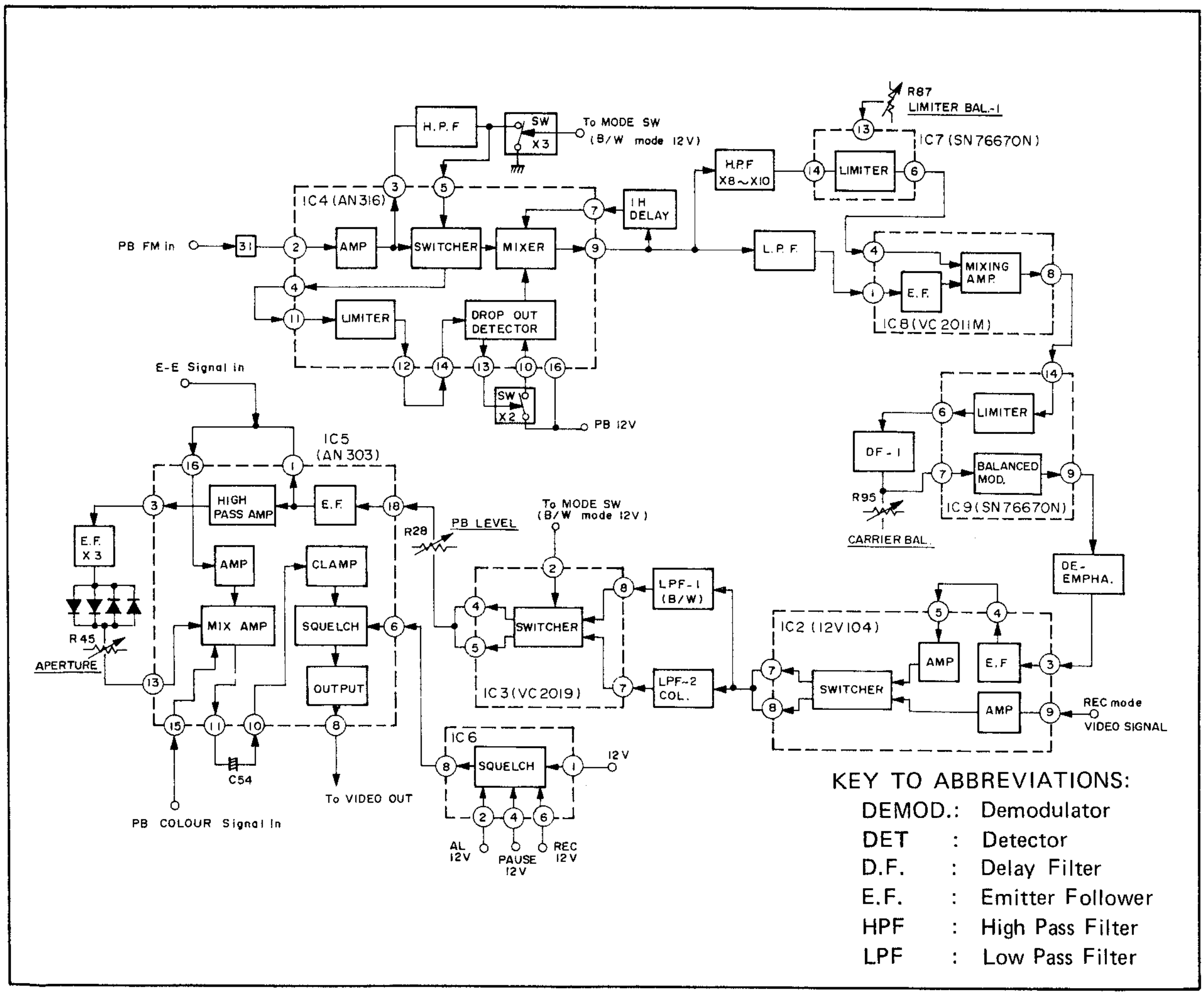
After passing through R52 the remaining signal 627.9 kHz ± 500 kHz is amplified by (PB COL. LEVEL), AMP IC4, then sent to colour circuit on the luminance and colour printed circuit board.

- ○ R55 (PB FM LEVEL) is a potentiometer for playback FM level.
- ○ R52 (P.B. COL. LEVEL) is a potentiometer for a playback colour level.
- ○ L6 (820 μH) and C37 (0.0056) are traps to check interference of audio bias at the after-recording.

3-2-5 Luminance signal reproduction system

Refer to Fig. 3-15.

The FM playback signal from the preamplifier is fed to an HPF after passing through the amplifier IC4. The HPF


H.P.F
SW
X3
To MODE SW
(B/W mode 12V)
R87
LIMITER BAL.-I
IC7 (SN76670N)
H.P.F
X8~X10
LIMITER
IC4 (AN316)
1 H
DELAY
PB FM In
31
AMP
SWITCHER
MIXER
L.P.F.
MIXING AMP.
E.F.
IC8 (VC2011M)
LIMITER
DROP OUT DETECTOR
E-E Signal In
SW
X2
PB 12V
LIMITER
DF-1
BALANCED MOD.
R95
IC9 (SN76670N)
CARRIER BAL.
IC5
(AN303)
HIGH PASS AMP
E.F.
To MODE SW
(B/W mode 12V)
PB LEVEL
R28
E.F.
X3
AMP
CLAMP
LPF-1
(B/W)
DE-EMPHA.
MIX AMP
SQUELCH
SWITCHER
IC2 (12V104)
R45
APERTURE
AMP
E.F
OUTPUT
IC3 (VC2019)
LPF-2
COL.
SWITCHER
AMP
REC mode
VIDEO SIGNAL
IC6
SQUELCH
12V
C54
To VIDEO OUT
PB COLOUR Signal In
AL
12V
PAUSE
12V
REC
12V

KEY TO ABBREVIATIONS:

DEMOD.: Demodulator

DET : Detector

D.F. : Delay Filter

E.F. : Emitter Follower

HPF : High Pass Filter

LPF : Low Pass Filter

Fig. 3-15 Block diagram of luminance signal reproduction system

eliminates the chroma signal then sent to the Mixer. The D.O.C. (Drop-out Compensator) eliminates drop-out caused by the loss of the FM signal due to damage or scratches on the magnetic tape.

After passing through the mixer, the FM signal is divided. The low component of the FM signal passes through a low-pass filter (LPF), and high component of the FM signal passing through HPF. The high component of FM signal is sent to limiter and mixed with the low component of the FM signal at the mixing amplifier IC8.

Although the signals have gone through several stages of limiting, the process of drop-out correction may introduce some additional amplitude variations. Therefore, a limiter is provided to remove amplitude variations entirely.

Integrated Circuit, IC9 (SN76670N) is a delay line type demodulator combined with DF-1 (DELAY FILTER), and demodulates the FM signal.

The demodulated signal is sent to a de-emphasizer which compensates its frequency characteristic (Contrary characteristic of pre-emphasis is recording), then sent to E.F. of IC2.

After passing through the AMP. IC2, signal sent to a SWITCHER which selects the playback signal path or record signal path. Then, this signal fed to LPF-1 and LPF-2.

Integrated Circuit, IC3 (VC2019) is an electronic switcher, when the colour signal appeared at pin 7 or 8 of IC2, video signal is first supplied to LPF-2 (Low-Pass-Filter) which rolls off at 3.3 MHz will pass through the SWITCHER of IC3.

When the black-and-white signal appeared at pin 7 or 8 of IC2, video signal is first supplied to LPF-1, which rolls off at 4.1 MHz will pass through the SWITCHER of IC3.

After passing through the SWITCHER, this video signal is determined its level by R28 (P.B. LEVEL), then sent to pin 18 of IC5, E.F.

After passing through R28 (P.B. LEVEL), the video signal is sent to the aperture, which compensates its higher frequencies.

The compensated video signal is mixed with the signal coming from IC5 (Amplifier) by IC5 (Mixing Amplifier) and also mixed with colour signal so as to be sent to the audio and servo circuit board as the video output signal.

The video signal which passed through the mixing amplifier is clamped by IC5 (Clamper) and will finally be the video output after passing the squelch output.

Electronic-to-Electronic mode, the video signal from the AGC output is supplied to IC5 (Amplifier) and finally sent to the video output through the mixing amplifier, clamper and squelch output.

NOTE: Only when the REC button is pressed, the Electronic-to-Electronic (E-E) mode functions.

1. AMPLIFIER (AMP), HIGH PASS FILTER (HPF) and MIXER – IC4 (AN316)

Refer to Fig. 3-15.

This circuit eliminates drop-outs caused by the loss of the FM signal.

The playback FM signal is first supplied to pin 2 of IC4 to be amplified by an amplifier (AMP), then supplied to pin 3 of IC3. The amplified FM signal is supplied to the high-pass filter (HPF) made up of C29, C31 and L7 which passes through the FM signal component, then fed to pin 5 of IC4. The FM signal reaches pin 4 of IC4 after passing through a differential amplifier and an emitter follower, and then fed to pin 11 of IC4 after passing through C30, R32 and C38.

After passing through the limiter, the FM signal is fed to pin 12 of IC4 and supplied to pin 14 of IC4.

Then, the output signal of the drop-out detector of pin 13 of IC4 is sent through the low-pass-filter (LPF) made up of L8, C32 and C33, so a drop-out appears to be a pulse at the gate of X2 (Detector Drive) as a switching pulse.

This switching pulse is fed to pin 10 of IC4 drop-out detector (Drop-out Det). On the other hand, FM signal coming from pin 5 of IC4 is supplied to pin 9 of IC4 after passing through the emitter follower and the mixer. This output is always supplied through 1-H Delay Line (DL-1) to pin 7 of IC4. This 1-H delayed RF signal is mixed with the signal from the drop-out detector. Normally, the limiter and the drop-out detector circuit are not operating so that the delayed RF signal does not appear to the mixer. However, when a drop-out occurs, the drop-out detector sends a gate pulse to the mixer, so the delayed RF signal from the high-pass filter will appear at the mixer.

Note: DOC (Drop-out Compensator) detection sensitivity is decided according to the ratio of resistance distributions between R32 and R39.

2. Duplex Limiter circuit

As this model is designed to be affected more strongly by pre-emphasis than conventional models, so the FM modulated signal is apt to arise AM variation at the high frequency component of the video signal. If the FM signal is limited only once by a limiter, there occurs shortage of the FM signal which causes black-and-white reverse phenomenon as shown in Fig. 3-16.

Refer to Fig. 3-17.

High component of the signal which especially causes black-and-white reverse phenomenon is firstly picked up (in other words element of AM variation is eliminated) by HPF (b) composed of X8 – X10, and then the picked up signal is limited by the first limiter (c).

At the same time lower component of the signal which also includes important information is picked up by LPF (d) (C43, L10, R42).

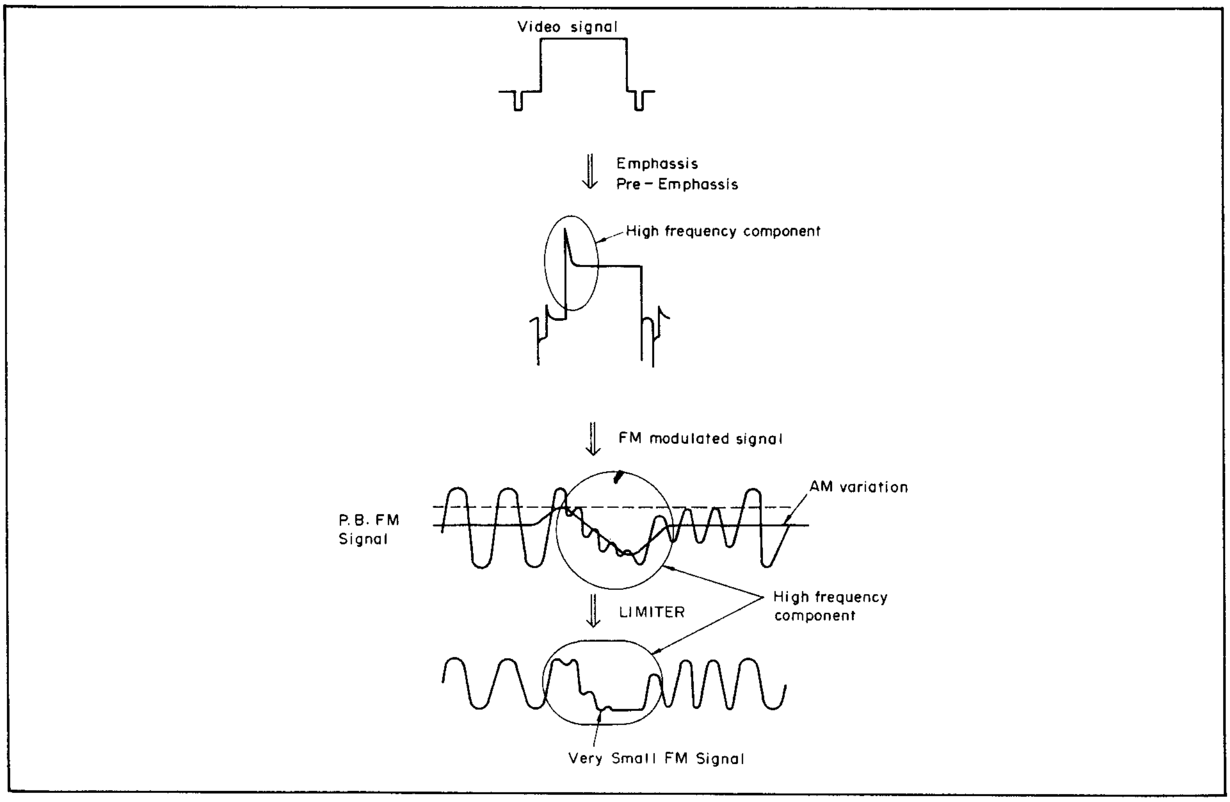

Video signal
Emphassis
Pre – Emphassis
High frequency component
FM modulated signal
AM variation
P.B. FM Signal
High frequency component
LIMITER
Very Small FM Signal

Fig. 3-16 Limiter

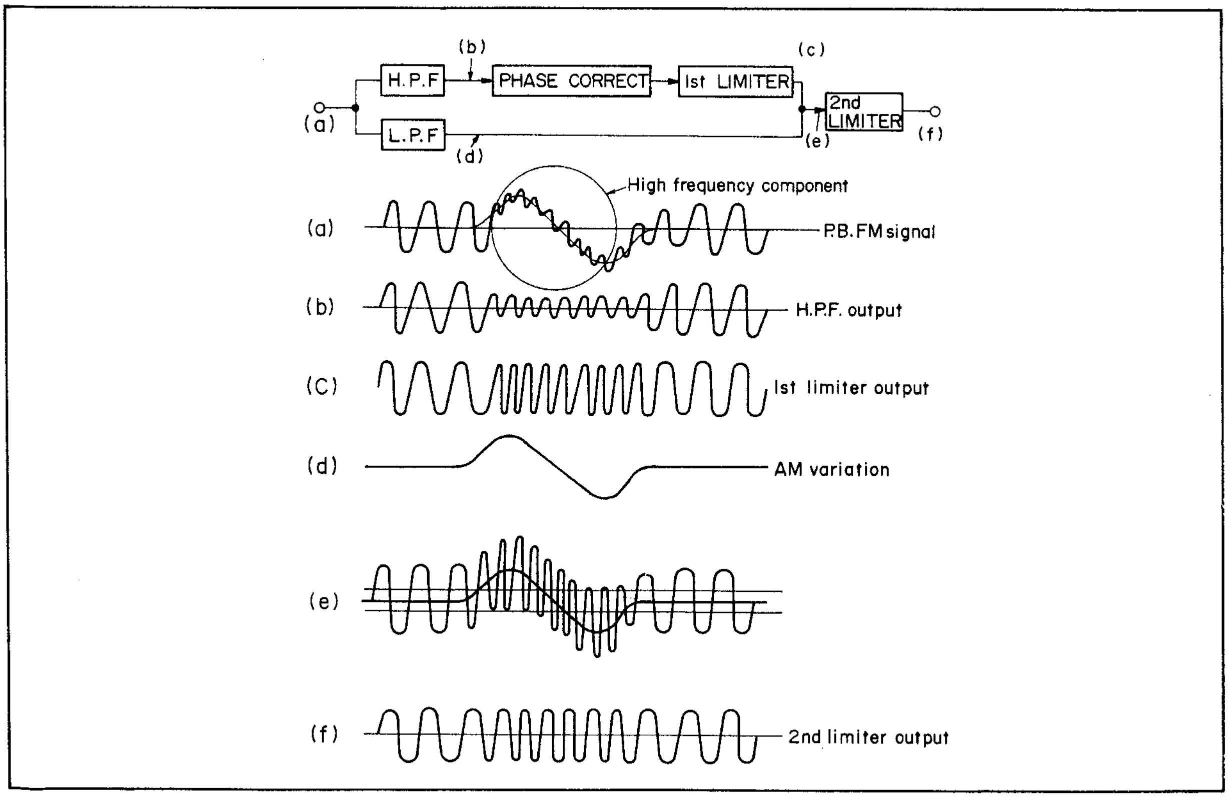

(b)
(c)
H.P.F
PHASE CORRECT
Ist LIMITER
2nd LIMITER
(a)
L.P.F
(d)
(e)
(f)
High frequency component
(a)
P.B.FM signal
(b)
H.P.F. output
(C)
Ist limiter output
(d)
AM variation
(e)
(f)
2nd limiter output

Fig. 3-17 Duplex limiter

Both the elements are mixed by the mixing amplifier IC8 (e) and the mixed FM signal is sent to the second limiter IC9 (f) which is provided to remove amplitude variation entirely. This unit has two limiters in two stages for improving the signal-to-noise ratio and prevent the black-and-white reverse phenomenon.
Such the system is called the Duplex Limiter circuit.

3. De-modulator (IC9) (BALANCED MODULATOR)

The demodulation system employed in the HR-3300E is the delay line type phase detection demodulator consisting of IC9 and delay line DF-1.
All illustrations of the fundamental concept appear in Fig. 3-18, block diagram and corresponding waveforms, respectively.

4. DE-EMPHASIS, SWITCHER (IC2), LPF-1, LPF-2, SWITCHER (IC3)

At modulation in recording amplifier, higher frequency component of the video signal is emphasized by the pre-emphasis. De-emphasis is set in order to attenuate the emphasized high component by its characteristic contrary to that of pre-emphasis and to reduce noise in higher band at the same time.
De-emphasized is composed of R105, 106 and C100, 101, 103.
De-emphasized signal is supplied to E.F. and AMP. then supplied to SWITCHER which selects the video signal, record mode signal path or playback mode signal path, then sent to LPF-1 and LPF-2.
After passing through LPF-1 and LPF-2, signal sent to SWITCHER (IC3) which selects the colour mode signal pass (SWITCHER IC2 – LPF-2 – pin 7 of IC3, SWITCHER) or black-and-white mode signal path (SWITCHER, IC2 – LPF-1, pin 8 of IC3 SWITCHER).
Luminance signal which passed through LPF-1 or LPF-2 is supplied to IC2 (E.F.) after its level is determined by R28 (P.B. LEVEL).

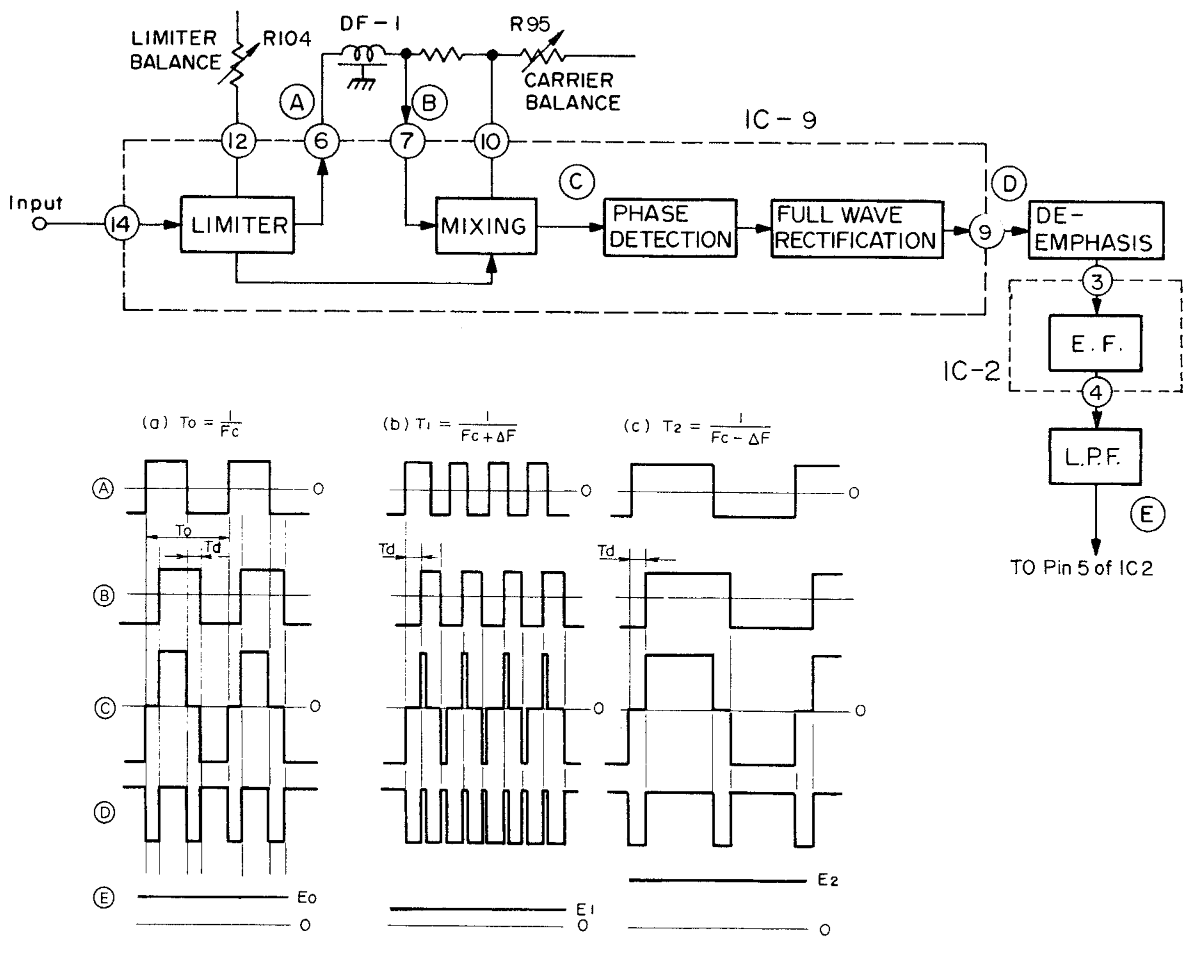

LIMITER BALANCE
R104
DF – I
R95
CARRIER BALANCE
IC – 9
Ⓐ
Ⓑ
Ⓒ
Ⓓ
Ⓔ
12
6
7
10
14
9
3
4
Input
LIMITER
MIXING
PHASE DETECTION
FULL WAVE RECTIFICATION
DE-EMPHASIS
E.F.
IC-2
L.P.F.
TO Pin 5 of IC2
(a) To = 1/Fc
(b) T₁ = 1/(Fc+ΔF)
(c) T₂ = 1/(Fc−ΔF)
To
Td
Eo
E1
E2
0

Fig. 3-18 Demodulator block diagram and waveforms

5. NOISE SUPPRESSOR CIRCUIT – IC5

The playback luminance signal is supplied to pin 18 of IC5 and fed to pin 1 of IC5 through E.F. (Emitter Follower). This output signal devided into two signals, one whose high frequency component is attenuated by LPF (R53, C62) will be supplied to pin 2 of IC5. After passing through the high-pass amplifier (H.P. AMP), the high-frequency component appears at pin 3 of IC5. The other output is supplied to pin 16 of IC5. Also, in record mode, the electronic-to-electronic (E-E) signal is supplied to pin 16 of IC5. Output from pin 3 of IC5 is supplied to the emitter follower (E.F.) X3 and sents to D6–D9 to pick up its higher element than ± 0.3 V. R45 (Aperture) is set for adjusting the level of the higher element, and the adjusted element will be supplied to pin 13 of IC5.

The mixing amplifier mixes three signals, namely, one is the luminance signal from pin 16 of IC5, the second is playback colour signal from pin 15 of IC5 and the rest is the higher element of the luminance signal coming from pin 13 of IC5.

The mixed signal is picked up at pin 11 of IC5 and sent to pin 10 of IC2 through C54, then the video signal is supplied through the CLAMP, SQUELCH, OUTPUT.

6. SQUELCH – IC6 (8V301)

Refer to Fig. 3-19.

The circuit is designed to cut-off the video signal. When the pin 6 of IC5 is charged with voltage coming from connector 26, so that Tr2 of IC6 is turned on and pin 8 of IC6 supplies low potential to pin 6 of IC5 SQUELCH, so that the SQUELCH will be released and video signal will be supplied to the OUTPUT.

In playback, when the loading arm reached to the end of loading, AL (After Loading) 12 volts power supply is supplied to pin 2 of IC6 through D1 of IC6 under the time constant of R2 of IC6 and C68, Tr2 turns on and SQUELCH is released.

In the still mode, the PAUSE 12 volts power supply is supplied to pin 4 of IC6, so that the Tr1 of IC6 turned on and collector voltage is held ground potential. Consequently, AL (After Loading) 12 volts does not be supplied to pin 2 of IC6. As a result Tr2 turns off and the SQUELCH will be functioning so the video signal is not supplied to the OUTPUT.

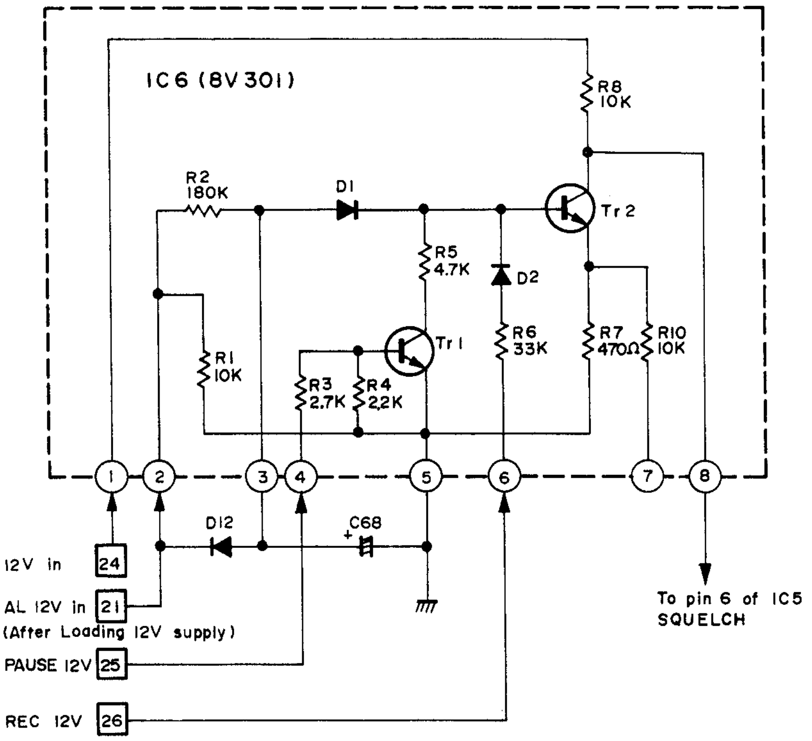


Fig. 3-19 Squelch

3-2-6 Colour signal playback system – Main path

Fig. 3-20 shows the block diagram of the main path of the colour signal playback system.

The playback colour signal from Preamplifier circuit board is supplied through IC201 (Amplifier) and E.F. to ACC (Automatic Colour Control). After passing through the ACC circuit, the colour signal is controlled to a constant level. Then the colour signal is supplied to the BALANCED MODULATOR which converts with the 5.06 MHz signal coming from Band-Pass-Filter (BPF-203). The signal from the BALANCED MODULATOR is fed to the band-pass filter (BPF-202), so that only the 4.43 MHz ± 500 kHz colour signal is sent to the emitter follower X204 (E.F.). Then the colour signal is supplied to X206 (AMP).

After passing through the emitter follower X204 (E.F.) the signal is supplied to DL202 (Delay Line) which eliminates cross-talk element of the signal component and improves its S/N ratio. After that, the signal is amplified by IC203 (Amplifier) and then supplied to the killer amplifier.

After passing through the killer amplifier the colour signal is sent to IC5, then it is mixed with luminance signal to be the video out signal.

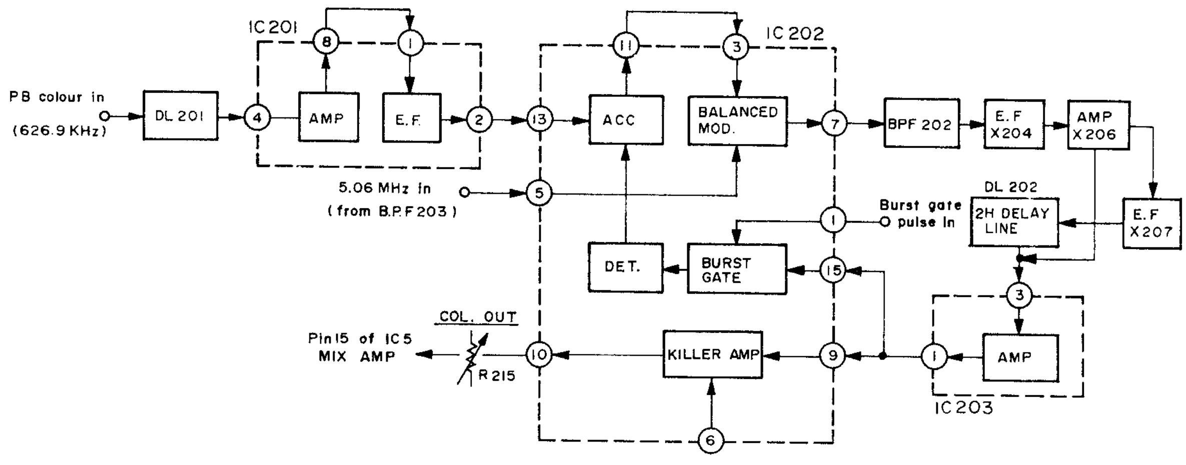
1. ACC – IC202 (AN305)

Playback colour signal from IC201 (Emitter Follower) is sent to pin 13 of IC202 Automatic Colour Control (ACC). ACC control system is as follows.

The colour signal amplified by IC203 is fed to pin 15 of IC202 GATE, and the burst separator pulse is supplied to pin 1 of IC202, so the burst signal which is separated from a colour signal is sent to ACC detector.

The ACC detector detects the burst level into DC potential, this DC voltage change is supplied to ACC circuit as a control voltage.

The ACC circuit in playback is in operation by detecting the peak value of the burst level of the playback signal. The colour signal which was controlled to have constant burst level by the ACC circuit is converted in its frequency by the main converter. As a result, both sum and difference frequencies will appear. The difference element (4.43 MHz ± 500 kHz) of colour signal is picked up by BPF-202.



KEY TO ABBREVIATIONS:

ACC : Automatic Colour Control

BPF : Band Pass Filter

D.L. : Delay Line

E.F. : Emitter Follower

SW : Electronic Switch

2H : two Horizontal Scanning Lines

Fig. 3-20 Colour signal playback system (Main path)

2. 2-H DELAY LINE FILTER (DL202)

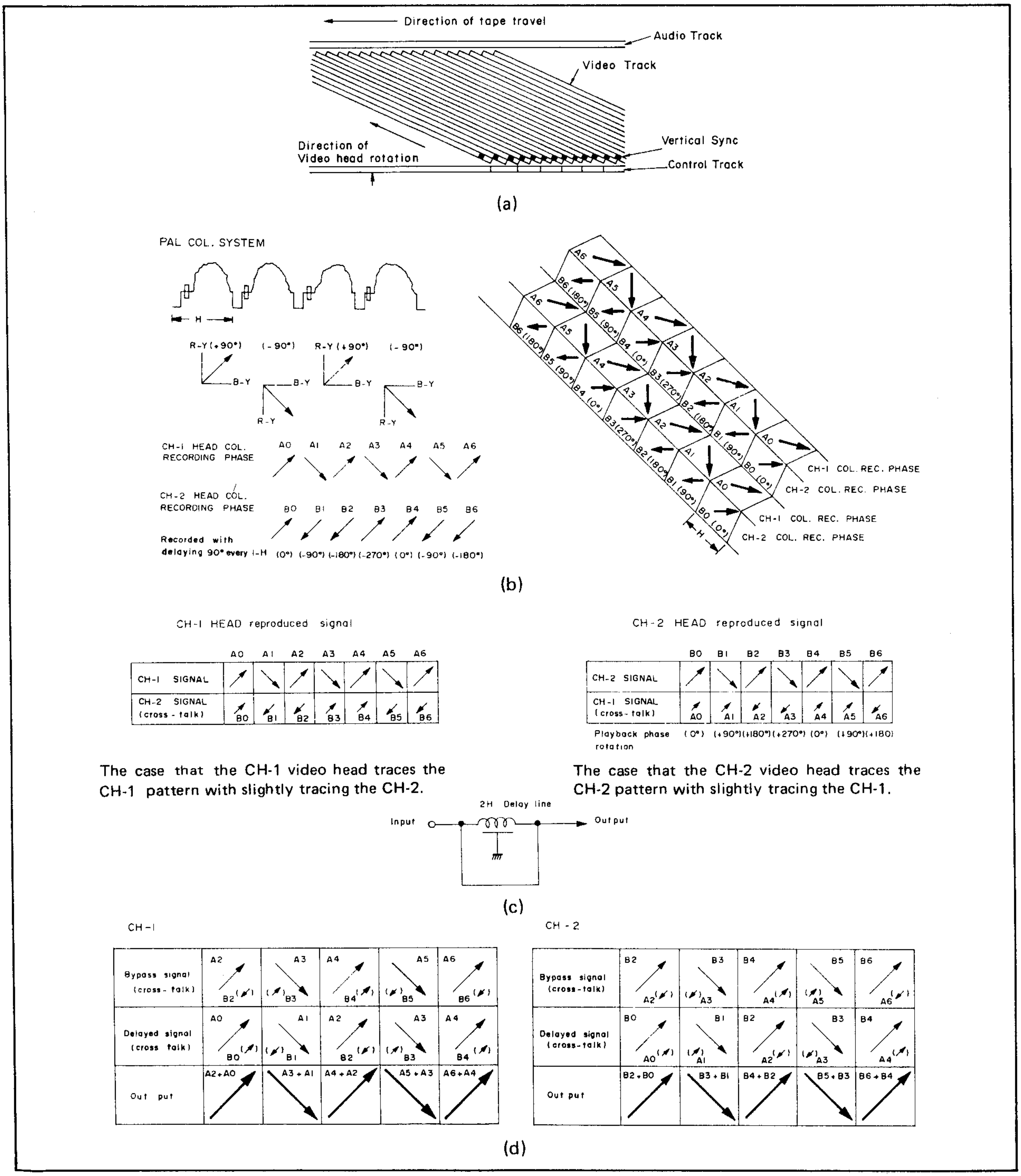
Refer to subsection 1-7-6 and 1-7-7.

Its function is to pass only 4.43 MHz (+ 500 kHz) colour signal. The circuit is composed of 2-H delay line and straight line as shown in Fig. 3-21(C).

In the VHS colour recording system, the following is shown in recording.

CH-1 track: Colour phase is recorded with normal phase.
CH-2 track: Colour phase is recorded with delaying 90° every 1-H.

Fig. 3-21 (A) shows video recording pattern.
Fig. 3-21 (B) shows colour recording phase.
Fig. 3-21 (C) shows playback colour phase.


Direction of tape travel
Audio Track
Video Track
Direction of Video head rotation
Vertical Sync
Control Track
(a)
PAL COL. SYSTEM
H
R-Y (+90°)
(-90°)
R-Y (+90°)
(-90°)
B-Y
R-Y
CH-1 HEAD COL. RECORDING PHASE
A0 A1 A2 A3 A4 A5 A6
CH-2 HEAD COL. RECORDING PHASE
B0 B1 B2 B3 B4 B5 B6
Recorded with delaying 90° every 1-H
(0°) (-90°) (-180°) (-270°) (0°) (-90°) (-180°)
B6 (180°) B5 (90°) B4 (0°) B3 (270°) B2 (180°) B1 (90°) B0 (0°)
CH-1 COL. REC. PHASE
CH-2 COL. REC. PHASE
(b)
CH-1 HEAD reproduced signal
CH-1 SIGNAL
CH-2 SIGNAL (cross-talk)
CH-2 HEAD reproduced signal
CH-2 SIGNAL
CH-1 SIGNAL (cross-talk)
Playback phase rotation
(0°) (+90°) (+180°) (+270°) (0°) (+90°) (+180°)
2H Delay line
Input
Out put
(c)
CH-1
CH-2
Bypass signal (cross-talk)
Delayed signal (cross-talk)
Out put
A2+A0 A3+A1 A4+A2 A5+A3 A6+A4
B2+B0 B3+B1 B4+B2 B5+B3 B6+B4
(d)

The case that the CH-1 video head traces the CH-1 pattern with slightly tracing the CH-2.

The case that the CH-2 video head traces the CH-2 pattern with slightly tracing the CH-1.

Fig. 3-21

The phase of the main signal for CH-1 is shown as in the figure, while the phase of cross-talk signal for CH-2 turns 90° every 1-H.

The signal is supplied to 2-H delay line filter. The main signal (CH-1) becomes a complex vector and the cross-talk signal is cancelled as shown in Fig. 3-21 (D). In other words, cross-talk signal is eliminated by the 2-H delay filter.

3. COLOUR KILLER AMPLIFIER (KILLER AMP) – IC202 (AN305)

The colour signal whose cross-talk element has been eliminated by the 2-H delay filter is supplied to the colour killer amplifier (IC202).

Refer to Fig. 3-22.

The colour killer amplifier is controlled by DC potential coming through pin 6 of IC202 being supplied by the killer detector IC205 (KILLER DETECTOR). When the pin 6 of IC202 is charged with high voltage (12 V DC, approx.) which is colour mode, the killer does not work and the colour signal passes through the killer amplifier and is supplied to pin 10 of IC202. In case of B/W signal, pin 6 of IC202 is charged with low voltage (0 V DC, approx.) and the killer is in operation, so no colour signal (actually that is, black-and-white signal leakage or noise components) appears at the pin 10 of IC202.

The colour signal passing through the colour killer amplifier is supplied to IC5 (AN303) which mixes it with luminance signal to make it the final video output signal.

The above is a description on the main signal of the colour signal playback system, and the following is described on APC system of colour signal playback.

3-2-7 Colour signal playback system – automatic phase control (APC) system

Refer to Fig. 3-23.

In recording mode, the automatic phase control (APC) system is not operating and the VXO (Variable Crystal Oscillator) works as a fixed oscillator to oscillate 4.43 MHz signal which is supplied to the BALANCED MODULATOR (IC208). On the other hand, the BALANCED MODULATOR is supplied with a 625 kHz signal from the AFC system to convert its frequency, and the converted signal is sent to BPF-203 which picks up the sum element of the signal (5.06 MHz) to supply it to the BALANCED MODULATOR (IC202).

In the playback mode, the automatic colour control (ACC) supplies 626.9 kHz ± Δf signal which includes such fluctual elements as jitter to the BALANCED MODULATOR (IC202). At the first stage the automatic phase control (APC) loop is not in operation yet and the variable crystal oscillator (VXO) oscillates 4.43 MHz signal. This 4.43 MHz signal and the 625 kHz ± Δf signal from AFC are both fed into the BALANCED MODULATOR (IC208). As a result, both sum and difference frequencies will be seen in the output. Then this output signal through the band-pass filter (BPF-203), so the only sum component (5.06 MHz ± Δf) is supplied to the BALANCED MODULATOR (IC202), and the 4.43 MHz (difference frequency component) can be taken out by the band-pass filter (BPF-202).

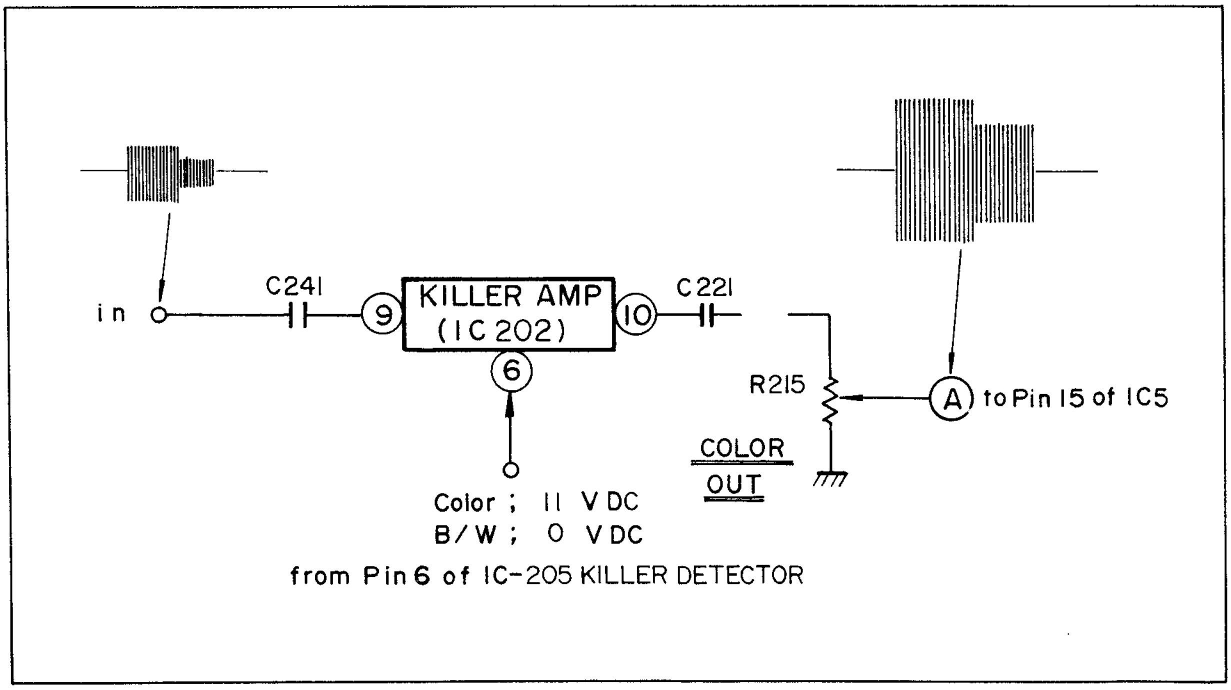
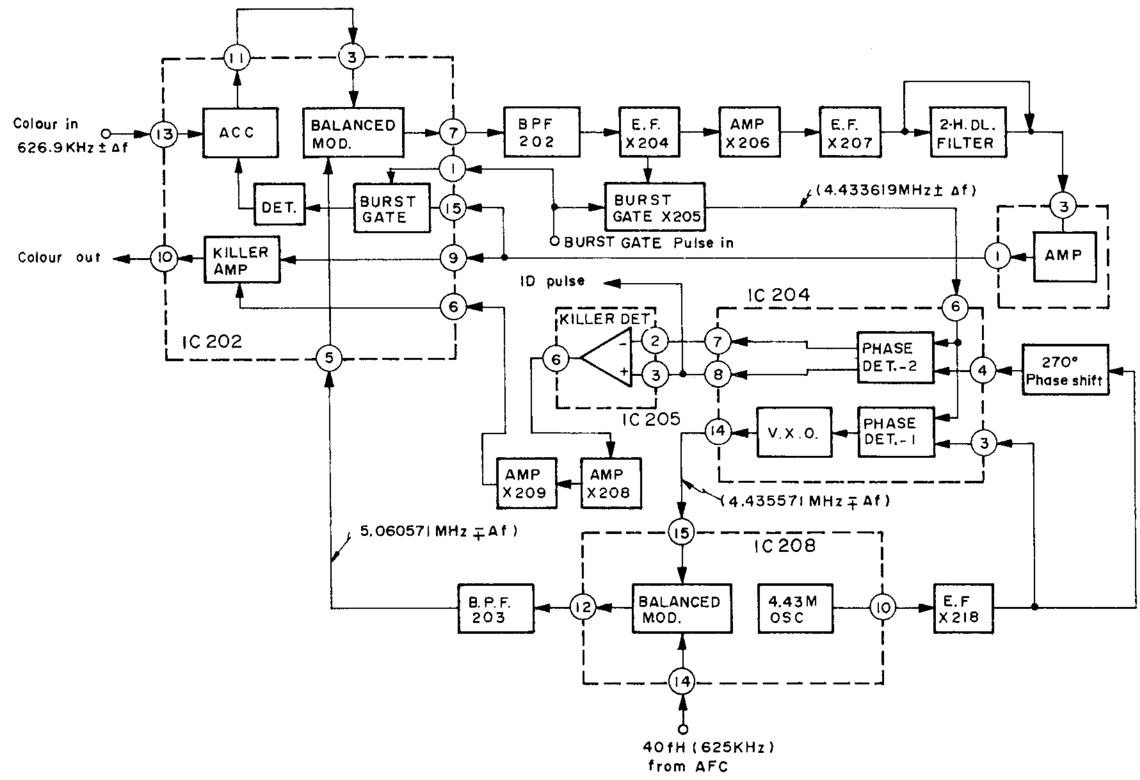


Fig. 3-22 Colour killer amplifier


Colour in
626.9KHz ± Δf
Colour out
ACC
BALANCED MOD.
DET.
BURST GATE
KILLER AMP
IC 202
BPF 202
E.F. X204
AMP X206
E.F. X207
2-H. DL. FILTER
BURST GATE X205
BURST GATE Pulse in
(4.433619MHz ± Δf)
AMP
ID pulse
IC 204
KILLER DET
IC 205
PHASE DET.-2
270° Phase shift
V.X.O.
PHASE DET.-1
AMP X209
AMP X208
(4.435571 MHz ∓ Δf)
5.060571 MHz ∓ Δf)
IC 208
B.P.F. 203
BALANCED MOD.
4.43M OSC
E.F X218
40fH (625KHz) from AFC
11
3
13
7
1
15
10
9
6
5
2
3
7
8
6
14
4
3
6
1
3
15
12
10
14

KEY TO ABBREVIATIONS:

BPF : Band Pass Filter

CONV. : Converter

D.L. FILTER: Delay Line Filter

E.F. : Emitter Follower

V.X.O. : Variable X'tal Oscillator

Fig. 3-23 Block diagram of automatic phase control (APC) system

On the other hand, the picked up 4.43 MHz $\pm\Delta f$ signal is supplied to the burst gate of X205, which picks up only burst signal of the colour signal and supplies it to the phase detector-1 and -2 (PHASE DET-1 and -2).

The 4.43 MHz signal from the crystal oscillator, IC208 and 4.43 MHz $\pm \Delta f$ signal from the burst gate are suppiled to the phase detector-1 (PHASE DET-1) which compares the phase of two signals and sends the error voltage to the variable crystal oscillator (VXO). Consequently, 4.43 MHz $\pm \Delta f$ signal comes out of the variable crystal oscillator to be supplied to BALANCED MODULATOR (IC208) and the band-pass filter (BPF-203) from which 5.06 MHz $\pm \Delta f$ signal is supplied to BALANCED MODULATOR (IC202).

After passing through APC system, the colour signal is obtained as the correct and stable 4.43 MHz (±500 kHz) output at the band-pass filter (BPF-202) output.

$(5.06 \text{ MHz} \pm \Delta f) - (625 \text{ kHz} \pm \Delta f) = 4.43 \text{ MHz}$

Both the burst signal from the burst gate X205 and continuous 4.43 MHz waveform from the IC208 are supplied to the phase detector-2 (PHASE DET-2). These two signals are compared in phase each other at the phase detector-2 (PHASE DET-2), and, if there is normal phase shift between them, a plus voltage is generated at the output.

The voltage is supplied to the killer detector (KILLER DET.) IC205 and high voltage output sends to the killer amplifier IC202 (Killer Amp.), so the colour signal (4.43 MHz ± 500 kHz) passes through to IC5 as the playback colour signal. On the other hand, if there is a difference of 180° phase-shift between the two signals at the phase detector-2, negative pulse is supplied to automatic frequency control (AFC) through the X217. This pulse is called ID Pulse (Identification Pulse).

As described above, APC functions in three ways, namely,

○ Phase control of colour signal,

○ Colour killer function by phase detection,

○ AFC control with ID pulse.

(Refer to Section 3-2-8 for details.)

1. CRYSTAL OSCILLATOR – IC208

This circuit operates only in playback, then it oscillates 4.433619 MHz signal correctly. This signal is supplied to the phase detector-1 and -2 (PHASE DET-1 and -2).

2. BURST GATE – X205

Refer to Fig. 3-24.

The playback colour signal is supplied to a gate of X205 through C231 and the burst gate pulse is supplied to the other gate of X205 through R230.

Accordingly, X205 is on (amplifying) only in receiving the burst gate pulse and burst signal appears at the drain.

Components L203, C233 and R231 compose the 4.43 MHz resonance circuit, and D203 and D204 work as the limiter.

This burst signal is supplied to the phase detector.

3. PHASE DETECTOR-1, -2 – IC204

The 4.43 MHz signal from the crystal oscillator and playback burst signal are supplied to the phase detector-1 (PHASE DET-1), and detects the phase shift between the signals. Refer to Fig. 3-25.

The phase detector-1 (PHASE DET-1) monitors the phase relationship between the 4.43 MHz signal from the crystal oscillator and the burst signal from the playback colour signal and converts any phase shift into a voltage change. This voltage change is then fed to the variable crystal oscillator (VXO). To illustrate the operation of the phase detector-1 (PHASE DET-1), we will assign the following definitions.

The 4.43 MHz ± Δf signal from the burst gate is = f_2

The 4.43 MHz reference signal from the crystal oscillator is = f_1

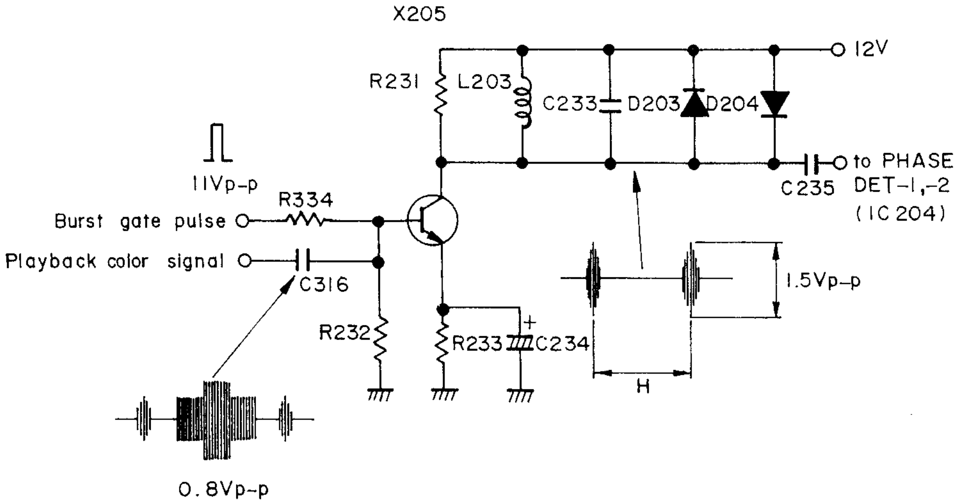

X205
12V
R231
L203
C233
D203
D204
to PHASE DET-1,-2 (IC204)
C235
11Vp-p
R334
Burst gate pulse
Playback color signal
C316
R232
R233
C234
1.5Vp-p
H
0.8Vp-p

Fig. 3-24 Burst gate

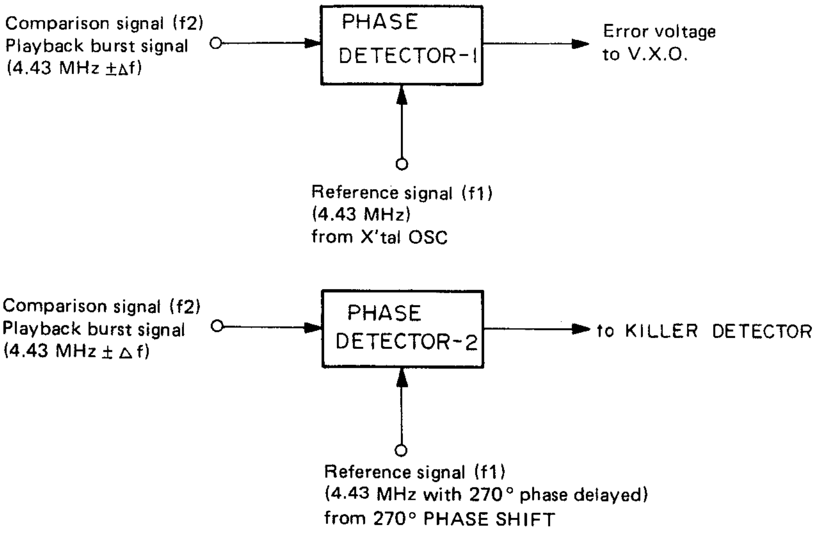

Comparison signal (f2)
Playback burst signal
(4.43 MHz ±Δf)
PHASE DETECTOR-1
Error voltage to V.X.O.
Reference signal (f1)
(4.43 MHz)
from X'tal OSC
Comparison signal (f2)
Playback burst signal
(4.43 MHz ± Δ f)
PHASE DETECTOR-2
to KILLER DETECTOR
Reference signal (f1)
(4.43 MHz with 270° phase delayed)
from 270° PHASE SHIFT

Fig. 3-25 Phase detector

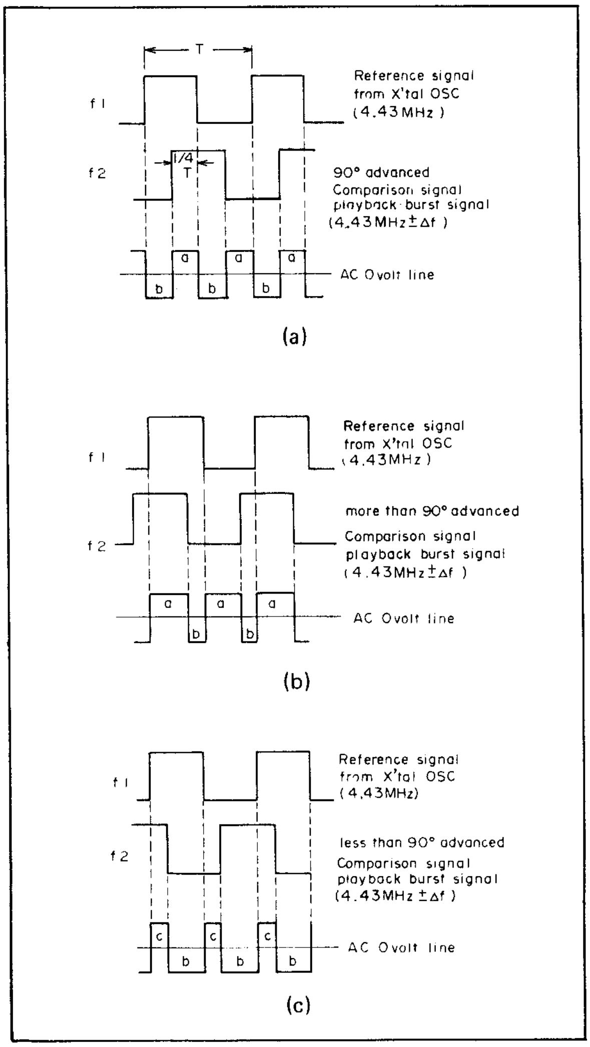

T
f 1
Reference signal from X'tal OSC (4.43MHz)
f 2
1/4 T
90° advanced Comparison signal playback burst signal (4.43MHz±Δf)
a
b
AC 0volt line
(a)
f 1
Reference signal from X'tal OSC (4.43MHz)
f 2
more than 90° advanced Comparison signal playback burst signal (4.43MHz±Δf)
a
b
AC 0volt line
(b)
f 1
Reference signal from X'tal OSC (4.43MHz)
f 2
less than 90° advanced Comparison signal playback burst signal (4.43MHz±Δf)
c
b
AC 0volt line
(c)

Fig. 3-26

Dependent upon the phase relation between these two signals, the following outputs are obtained from the phase detector-1 (PHASE DET-1).

In the case, the phase relation of f_2 (the burst signal from playback colour signal) advanced 90° to that of f_1 (4.43 MHz signal from the crystal oscillator), the output waveform shows the positive area (a) and negative area (b) is equal against the AC 0 volt line as shown in the figure. Therefore, reference voltage is supplied to the variable crystal oscillator.

Refer to Fig. 3-26 (b).

In the case, the phase relation of f_2 (the burst signal from the playback signal) advanced more than 90° to that of f_1 (4.43 MHz signal from the crystal oscillator), the output waveform shows (a) > (b) against the AC 0 volt line as shown in Fig. 3-26 (b). Therefore, the positive voltage against the reference voltage is supplied to the variable crystal oscillator.

Refer to Fig. 3-26 (c).

In the case, the phase relation of f_2 (the burst signal from the playback signal) advanced less than 90° to that of f_1 (4.43 MHz signal from the crystal oscillator), the output waveform shows (a) < (b) against the AC 0 volt line as shown in Fig. 3-26 (c). Therefore, the negative voltage against the reference voltage is supplied to the variable crystal oscillator.

The relation between the output and phase difference of the phase detector-1 is shown below.

Refer to Fig. 3-27.

The phase detector-1 detects phase of the playback colour signal. In the case, if the phase relation of f_2 advanced 90° against the f_1, the output of phase detector-1 is zero (reference voltage). In the range of ± 90° centralizing that point +90°, the output voltage corresponding to phase difference between f_1 and f_2 is obtained.

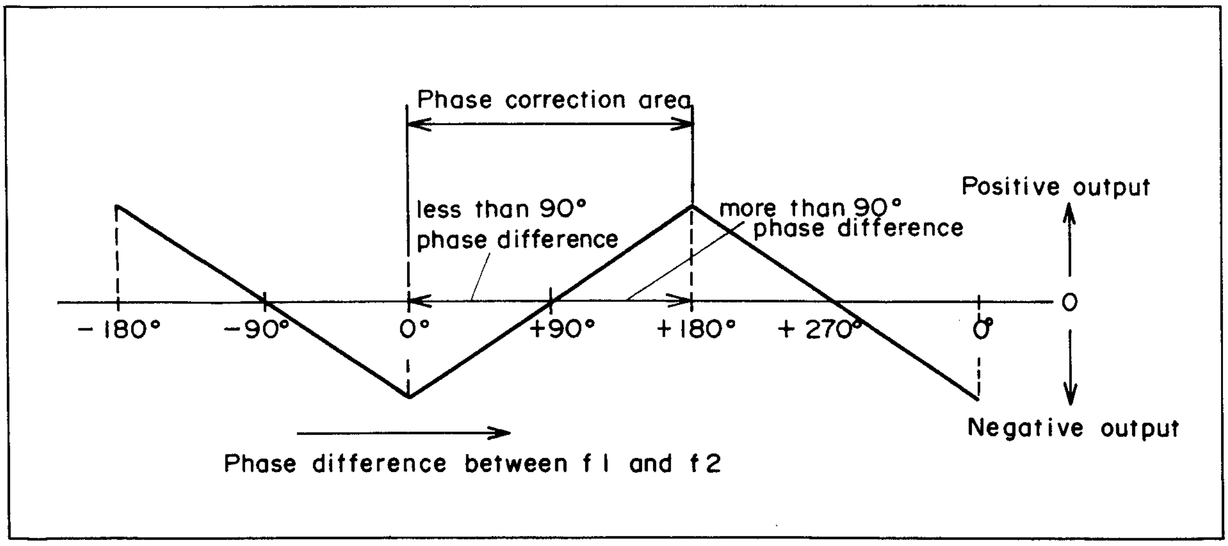


Fig. 3-27 Phase difference between f_1 and f_2

The phase detector-2 detects phase difference between them, and sends output signal to the colour killer circuit. The principle and output are the same as phase tector-1, but the 4.43 MHz signal from the crystal oscillator is 270° phase delayed by the 270° PHASE SHIFT.

This signal (270° phase advanced) is sent to the phase detector-2, so the relation between phase difference of f_1 and f_2 is shown in Fig. 3-28.

4. VARIABLE CRYSTAL (X'TAL) OSCILLATOR (VXO) – IC204

In Record mode, the crystal oscillator IC208 is not oscillating and no burst signal is supplied to the phase detector-1, the error voltage from the detector is "zero" (DC potential is nearly half of the power source voltage) which is supplied to VXO, and then it oscillates 4.43 MHz signal correctly. In Play mode, the oscillation frequency of the variable crystal oscillator (VXO) is controlled by the output of phase detector-1 (PHASE DET-1).

In Play mode, in case the phase relation of the 4.43 MHz signal from the playback burst signal is advanced 90° to that of the crystal oscillator signal, the output of the phase detector-1 is zero. Receiving this output, the variable crystal oscillator (VXO) oscillates constant 4.43 MHz signal correctly.

For example as shown in Fig. 3-29, if the phase relationship of P.B. burst signal is advanced (more than 90° advanced), the phase detector-1 output voltage is increased and this voltage is supplied to the VXO. This DC voltage controls oscillation of the VXO to delay the phase of 4.43 MHz signal.

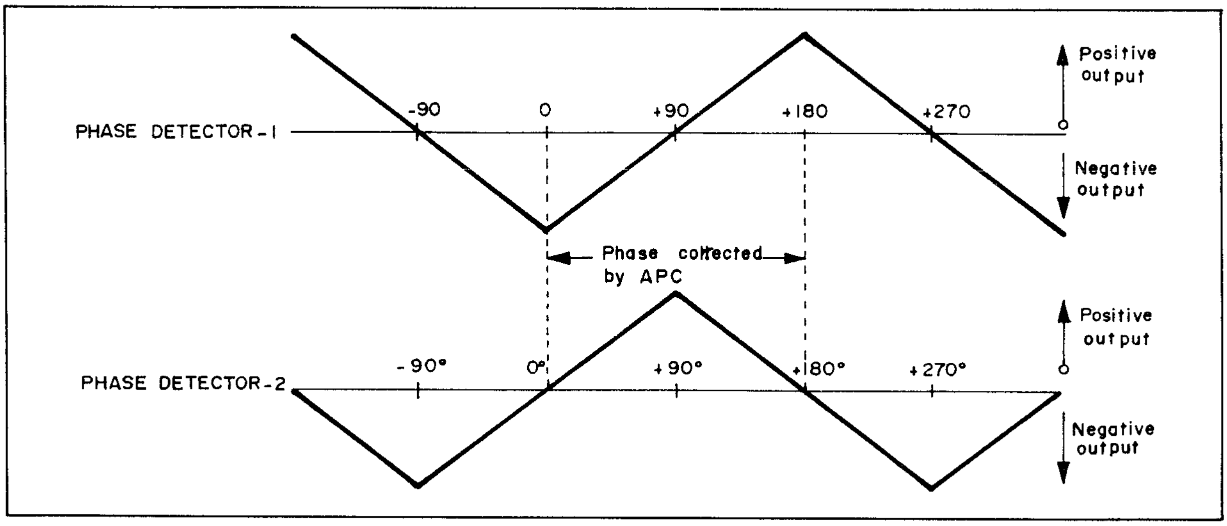

PHASE DETECTOR-1
-90
0
+90
+180
+270
Positive output
Negative output
Phase corrected by APC
PHASE DETECTOR-2
-90°
0°
+90°
+180°
+270°
Positive output
Negative output

Fig. 3-28

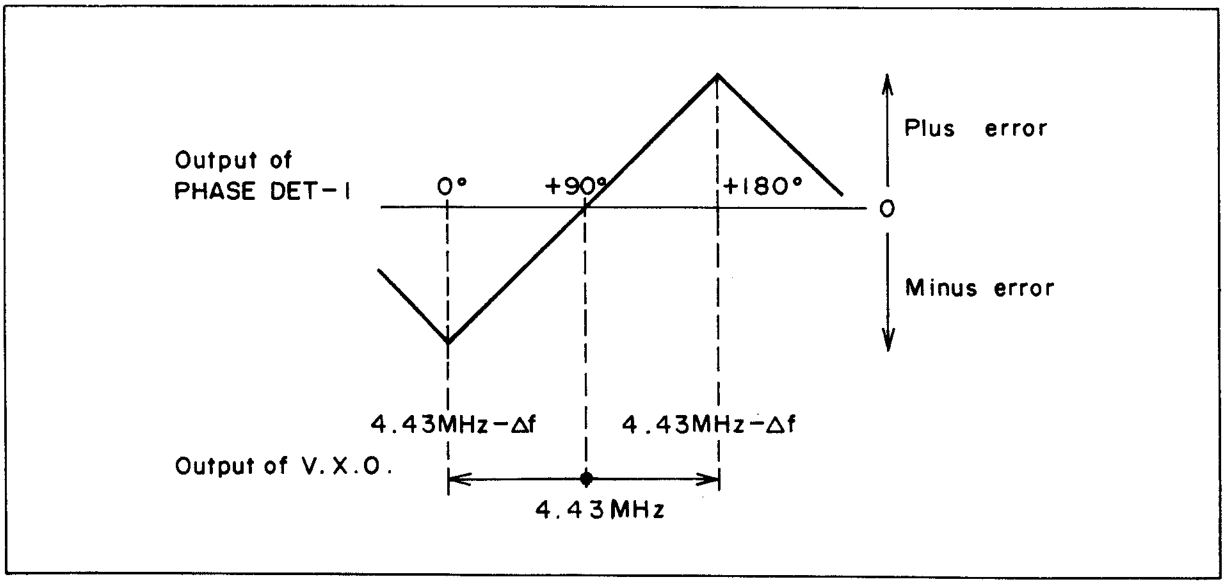

Output of PHASE DET-1
0°
+90°
+180°
Plus error
0
Minus error
4.43MHz−Δf
4.43MHz−Δf
Output of V.X.O.
4.43MHz

Fig. 3-29 Oscillation of the VXO

The phase detector-1 and the variable crystal oscillator are connected each other inside the IC204.
Refer to Fig. 3-30.
The VXO compensation circuit is set to avoid frequency variation of VXO, which happens in the case that DC potential of the phase detector-1 output drifts with temperature.
The VXO is the differential type whose input is connected with two systems; one, pin 11 of IC204 is connected with C256 and its time constant is large, the other, pin 12 of IC204 is connected with C253, C254 and R252 and its time constant is small. In addition, pin 10 of IC205 is supplied positive horizontal sync signal, which makes switching of the two input signals.
Therefore, if there is voltage drift, the circuit works to cancel any potential difference between the two input signals of the variable crystal oscillator (VXO), then the output of the variable crystal oscillator (VXO) will be no frequency change. This signal is supplied to the pin 15 of the BALANCED MODULATOR IC208.

5. KILLER DETECTOR – IC205
The killer detector circuit is controlled by the output signal from the phase detector-2.
Refer to Fig. 3-31, the normal playback colour signal, phase difference at phase detector-2 is within ± 90° against centering at 180° and all the output of the phase detector-2 is positive output (DC voltage is positive from the reference value as shown in Fig. 3-28). This positive output is picked up through pin 8 of IC204, supplied to

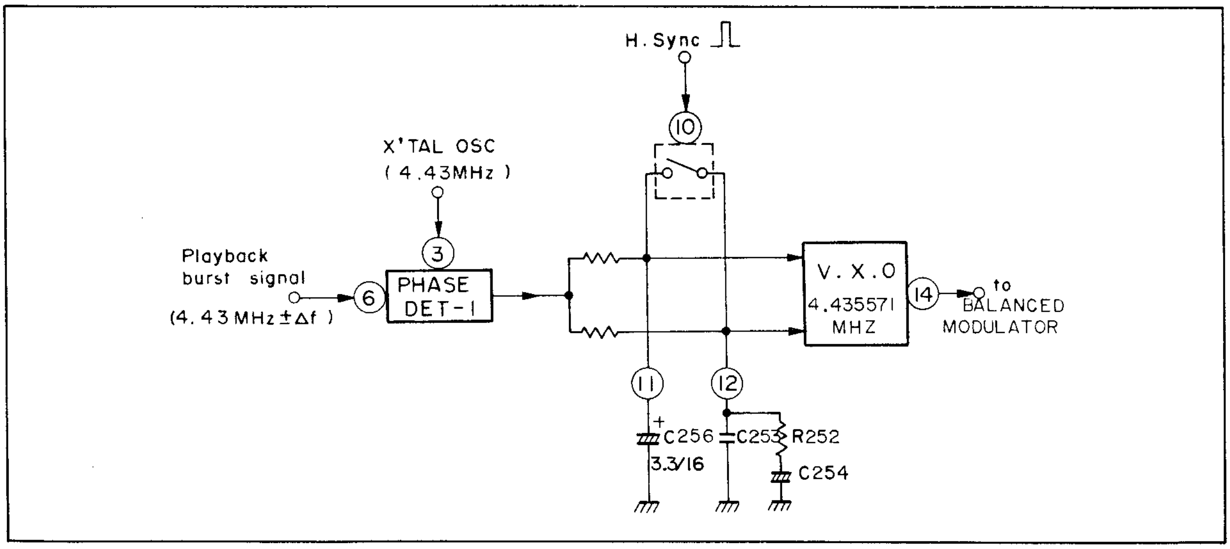

H. Sync
⑩
X'TAL OSC
(4.43MHz)
③
Playback
burst signal
(4.43MHz±Δf)
⑥
PHASE
DET-1
V.X.O
4.435571
MHZ
⑭
to
BALANCED
MODULATOR
⑪
⑫
C256
3.3/16
C253
R252
C254

Fig. 3-30 VXO compensation circuit

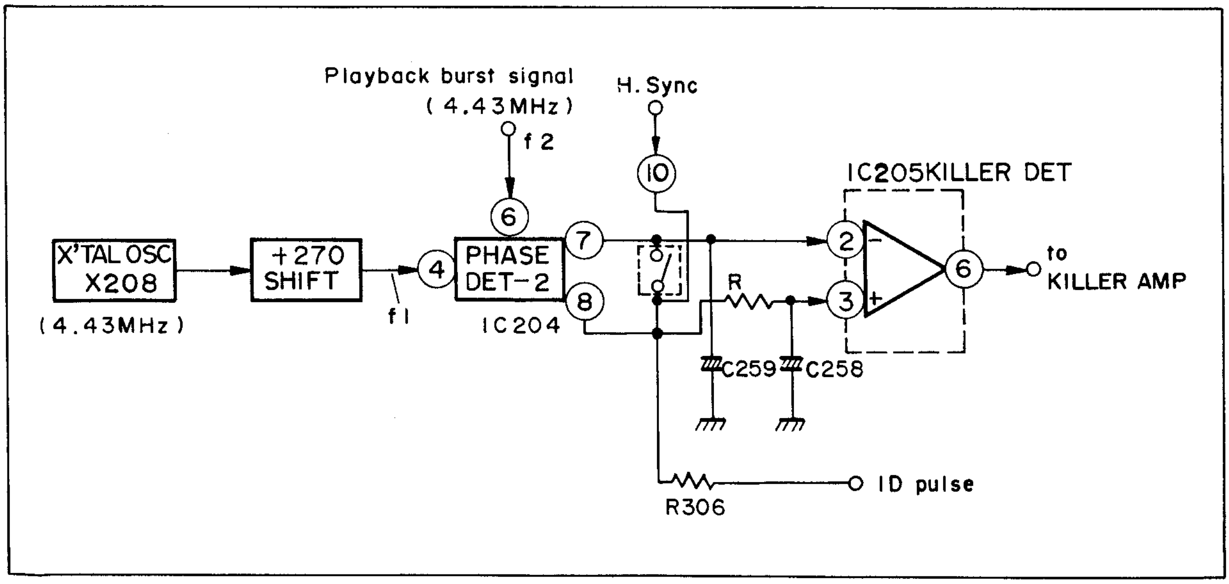

Playback burst signal
(4.43MHz)
f 2
H. Sync
⑩
IC205KILLER DET
X'TAL OSC
X208
(4.43MHz)
+270
SHIFT
f 1
④
⑥
PHASE
DET-2
IC204
⑦
⑧
R
②
③
⑥
to
KILLER AMP
C259
C258
R306
ID pulse

Fig. 3-31 Killer detector

"positive input" of the killer detector through R255, then amplified there to be the output of high voltage is supplied to the killer amplifier, the colour signal is able to pass through the killer amplifier.

The output of the phase detector-2 is "zero", and there is no potential difference between two inputs to the killer detector. As a result pin 6 of IC205 is charged with low voltage (2 V DC approx.), and the colour killer starts operation to cut colour signals.

As described in the section of the variable crystal oscillator (VXO), by supplying horizontal sync pulse to pin 10 of IC204, potential difference between the two inputs to pin 3 and pin 2 of IC205 is cancelled. Components C259, R255 and C258, all work for correct operation of the killer detector utilizing the difference of each time constant. The following is described on identification pulse (ID pulse) generation.

Refer to Fig. 3-27.

In the VHS PAL system, the phase of the CH-2 colour signal is rotated 90° every successive 1-H. If there is a difference between the timing in recording and in playback, the phase difference between f_1 and f_2 is considered to be more than ±90°.

The response range of the phase detector-1 detecting colour phase is between 0° and 180° in principle, (refer to Fig. 3-29), however, in actual there is a possibility to occur larger phase difference. In this case it is impossible to control the phase difference by the automatic phase control (APC) system.

Because of the automatic phase control (APC) system corrects within ± 90° phase difference between the 4.43 MHz signal from crystal oscillator and playback burst signal.

Therefore, by utilizing the phase detector-2 which generates ID pulse when the phase difference is more than ± 90°, AFC system is controlled by receiving the minus output coming through R306 to base of X217 and the phase turns to normal phase.

This is the function of ID pulse. For details of ID pulse, refer to the section of "AFC".

3-2-8 Automatic frequency control (AFC) system

Refer to Fig. 3-32.

AFC system takes the same action both in recording and playback except the reference signal. In recording the reference signal is the horizontal sync pulse of the input video signal while the horizontal sync pulse of the playback video signal in playback.

The functions of AFC system:

○ to generate 40 x fH (15.625 kHz)
 (40 x 15.625 kHz = 625 kHz)

○ to make the 40 fH signal rotate every 1-H at CH-2.

○ to compensate phase control of the colour signal receiving ID pulse.

○ to make complete compensation with input horizontal sync pulse.

The horizontal sync pulse of the reference signal is supplied to pin 10 of IC207 of the monostable multivibrator which forms the signal to square waveform, then it is picked up through pin 14 of IC207.

This output is supplied to pin 7 of IC208 AFC PHASE DETECTOR as a reference horizontal (fH) signal.

On the other hand, 160 fH (2.5 MHz) signal is oscillated by the voltage control oscillator (VCO) (IC208).

This signal is picked up at pin 17 of IC208 and supplied to pin 6 of IC207 (1/4 COUNT DOWN) where the signal is counted down to 1/4 and sent to the 1/10 and 1/4 count down, so that the only fH signal is picked up through the pin 2 of IC207 and supplied to the pin 8 of IC208, AFC PHASE DETECTOR as a comparison fH signal.

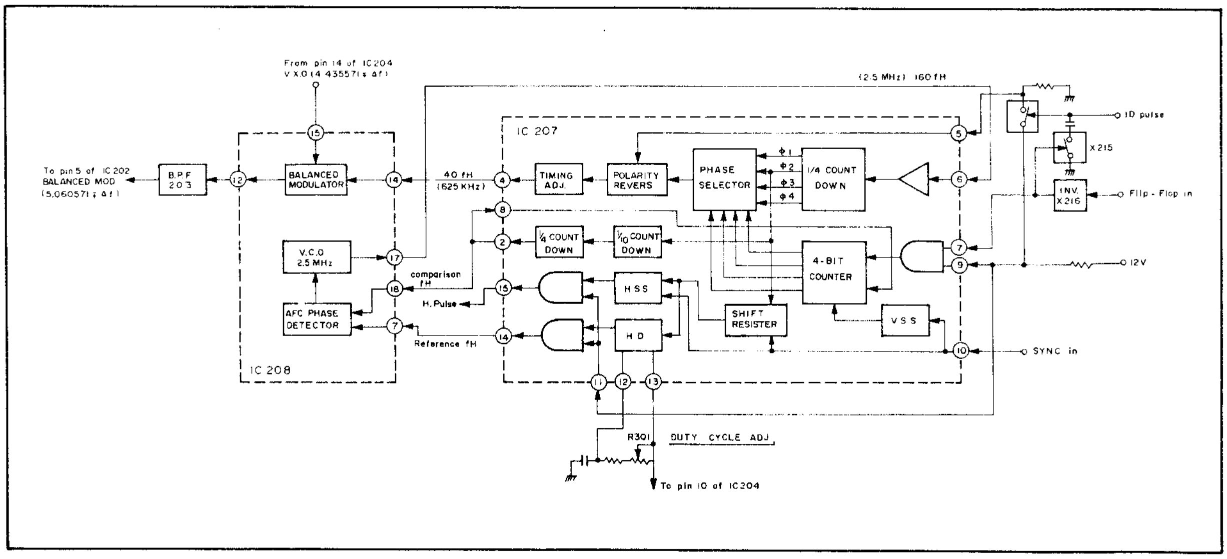

From pin 14 of IC204
VXO (4.43557I ∓ Δf)
To pin 5 of IC202
BALANCED MOD
(5.06057I ∓ Δf)
B.P.F
203
BALANCED
MODULATOR
V.C.O
2.5 MHz
AFC PHASE
DETECTOR
IC 208
40 fH
(625 KHz)
comparison
fH
H. Pulse
Reference fH
IC 207
TIMING
ADJ.
POLARITY
REVERS
PHASE
SELECTOR
φ1
φ2
φ3
φ4
1/4 COUNT
DOWN
¼ COUNT
DOWN
⅒ COUNT
DOWN
4-BIT
COUNTER
H S S
H D
SHIFT
RESISTER
V S S
(2.5 MHz) 160 fH
ID pulse
X215
INV.
X216
Flip - Flop in
12V
SYNC in
R301
DUTY CYCLE ADJ
To pin 10 of IC204
15
12
14
17
18
7
4
8
2
15
14
5
6
7
9
10
11
12
13

Fig. 3-32 Block diagram of AFC system

The AFC PHASE DETECTOR (IC208) detects the phase of the reference fH (Sync signal) and comparision fH to generate error voltage, which will be fed to VCO (Voltage Control Oscillator) for oscillating correct 160 fH (2.5 MHz) signal.

Namely, there is generated 160 fH which synchronizes perfectly to input fH.

This 160 fH signal is supplied to pin 6 of IC207, 1/4 COUNT DOWN and PHASE SELECTOR which is the most important part of AFC that generates 40 fH (625 kHz) signal and rotates it by 90° every 1-H at CH-2 and normal phase at CH-1.

The 40 fH (625 kHz) signal generated in the above manner is supplied to pin 14 of IC208 (BALANCED MODULATOR), where frequency conversion of the signal is made with 4.43 MHz element coming from V.X.O. After that, sum element of the signal (5.06 MHz) is picked up by BPF-203 and finally the element will be supplied to pin 5 of IC202 (BALANCED MODULATOR).

All the signals concerned to the IC are shown in Fig. 3-32. The AFC system operates in the same manner both in recording and playback. In explaining on the side of CH-1, the colour signal phase is normal every 1-H and the CH-2 colour signal phase delayed 90° ever 1-H in recording, while in playback the original colour signal can be reproduced by advancing 90° every 1-H at CH-2.

2. ID pulse (Identification pulse)

In playback, however, there is a fear that the reference horizontal sync signal may be distorted owing to drop-out or switching point. For example, there might be a interference pulse supplied at a part of waveform.

In this case, this interference signal is detected with the comparison fH signal at the AFC phase detector and error voltage controls the VCO (Voltage Controlled Oscillator), so that the VCO oscillates the incorrect frequency.

Then the final output colour signal phase difference is more than 90° to the normal recorded colour phase. In such the case it cannot be compensated by APC system because it functions within 90° and it is hopeless to obtain normal playback colour signal.

Therefore, there arises the necessity of an ID pulse which controlls the AFC system to obtain the normal colour phase.

Namely, when there occurs advance or phase difference by more than ± 90°, the phase detector-2 generates a low pulse. This pulse (ID pulse) supplied to pin 5 of IC207 POLARITY REVERSE to reverse the output colour signal phase. Then after timing runs back to the normal condition. Regarding the reason why ID pulse is generated when the phase difference is more than ± 90°, refer to the subsection 3-2-7 (3) and (5).

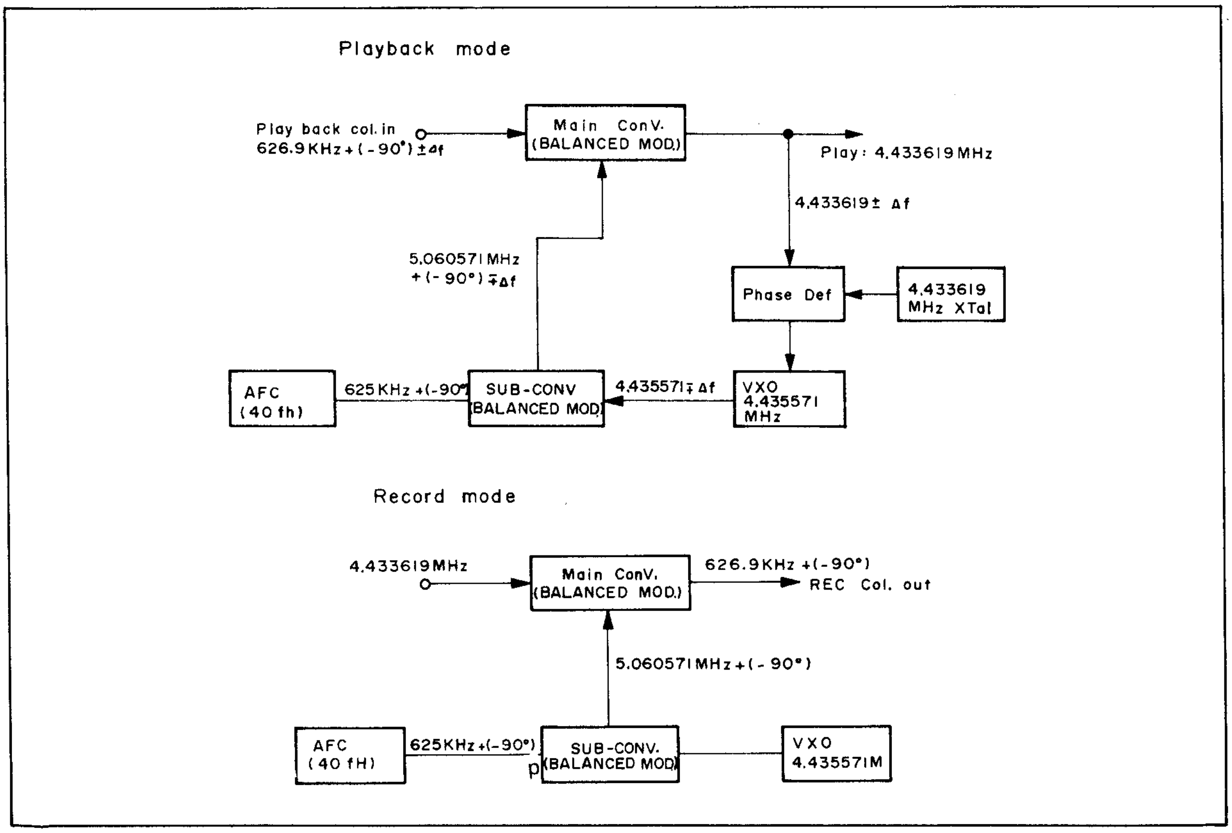

Playback mode
Play back col. in
626.9KHz+(-90°)±Δf
Main ConV.
(BALANCED MOD.)
Play: 4.433619MHz
4.433619± Δf
5.060571MHz
+(-90°)∓Δf
Phase Def
4.433619
MHz XTal
AFC
(40 fh)
625KHz+(-90°
SUB-CONV
BALANCED MOD
4.435571∓Δf
VXO
4.435571
MHz
Record mode
4.433619MHz
Main ConV.
(BALANCED MOD.)
626.9KHz+(-90°)
REC Col. out
5.060571MHz+(-90°)
AFC
(40 fH)
625KHz+(-90°)
p
SUB-CONV.
(BALANCED MOD)
VXO
4.435571M

Fig. 3-33

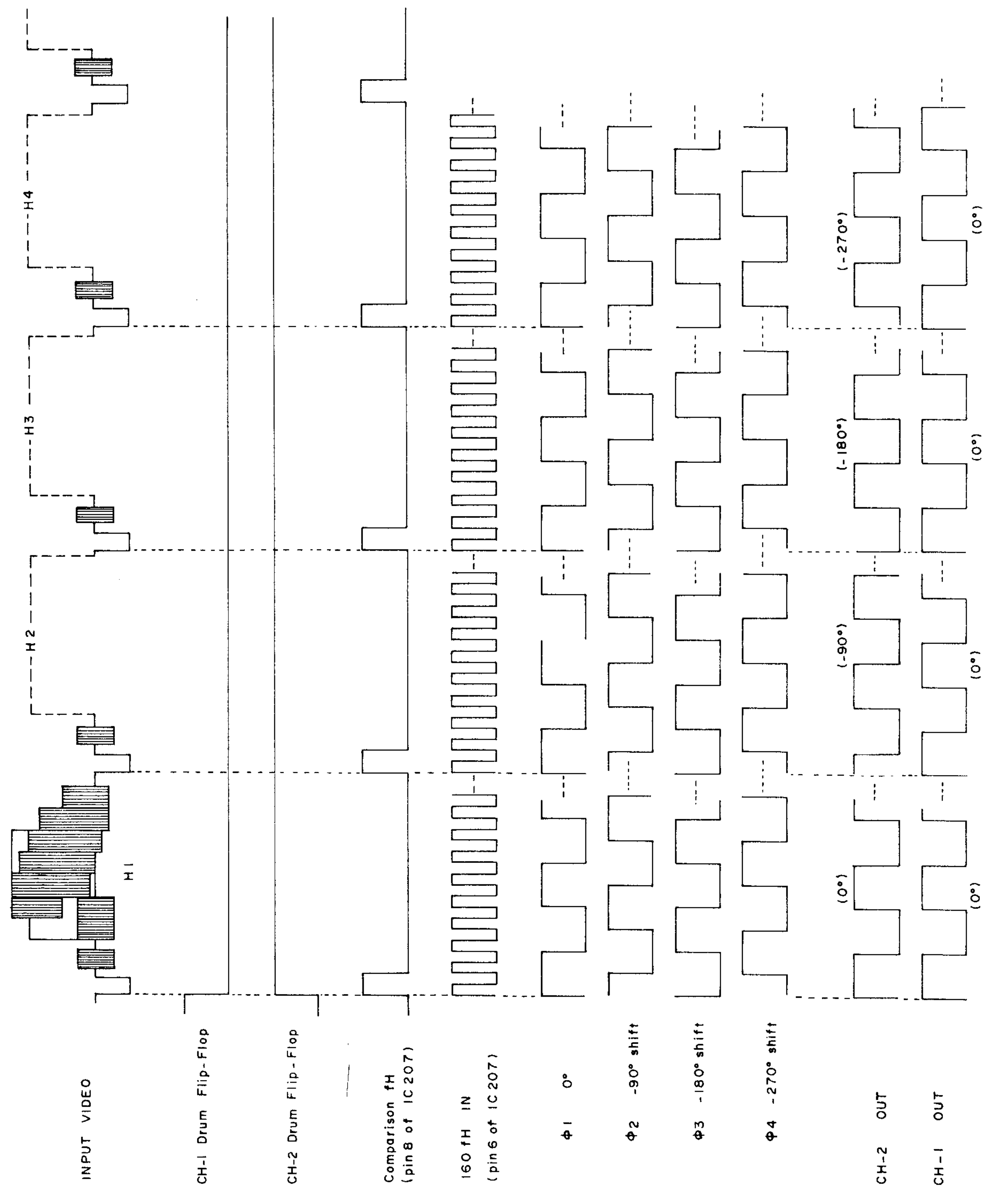

INPUT VIDEO
CH-1 Drum Flip-Flop
CH-2 Drum Flip-Flop
Comparison fH
(pin 8 of IC 207)
160 fH IN
(pin 6 of IC 207)
Φ1 0°
Φ2 -90° shift
Φ3 -180° shift
Φ4 -270° shift
CH-2 OUT
CH-1 OUT
H1
H2
H3
H4
(0°)
(-90°)
(-180°)
(-270°)
(0°)
(0°)
(0°)
(0°)

Fig. 3-34 Timing chart

3-3 SERVO CIRCUIT

3-3-1 General

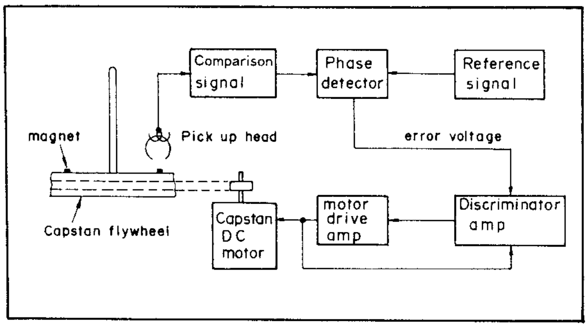
A circuit which controls frequency of rotation, phase or position of a mechanism is generally called a servo circuit. By this definition, the circuits of the HR-3300E which control the phase of the rotary video heads, capstan speed and the tape tension of video tape are called servo circuit. On Model HR-3300E, servo circuits provided for controlling the phase and speed of the rotary video head drum and maintaining the proper speed of the rotating capstan, that is, the tape speed. The HR-3300E's servo control has two parts: "drum servo" and "capstan servo". In the record mode, the drum servo system maintains constant relative position between the video heads and the vertical sync signal of the input video signal, and keeps the rotating frequency of the capstan constant. In playback mode, the drum servo system maintains the relative position between the video heads and the reference signal. The reference signal is a control signal, reproduced from the control track of the video tape. This permits accurate reproduction of the video signal recorded on the tape. For controlling the tension of the video tape, the HR-3300E is provided with a mechanical system.

3-3-2 Capstan servo system

The purpose of the capstan servo system is to make video tape travel constant at the speed of 2.339 cm/sec both in recording and playback. The model HR-3300E, being different from conventional VCR's, adopts a DC motor, so the servo system is composed of two systems, because the DC motor is apt to vary the speed of rotation corresponding to load variation and change of voltage.

One of the two systems is called Discriminator Control system and the other is Phase Control system.

The discriminator control system functions against large variation to make the rotation constant while the phase control system controls tape travelling to be constant against smaller variation.



Comparison signal
Phase detector
Reference signal
magnet
Pick up head
error voltage
Capstan flywheel
Capstan DC motor
motor drive amp
Discriminator amp

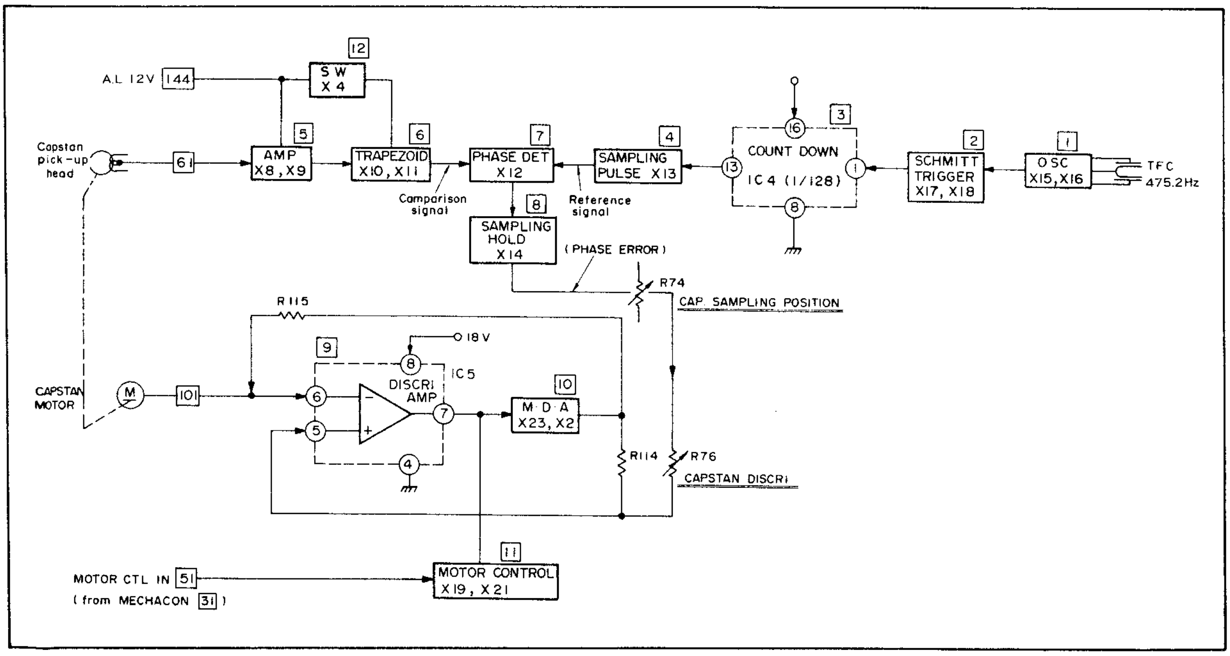
Fig. 3-35 Block diagram — Principles of capstan servo system

3-3-3 Capstan servo block diagram

An explanation of the block siagram follows.

Details of the circuit are as follows: Refer to the schematic diagram in Section 10-19.

In the phase control system of the capstan servo system, the reference signal is TFC (TUNING FORK) oscillation which makes the oscillator (X15, X16) generate 475.2 Hz sine waveform signal. This signal is supplied to X17 and X18 which converts its waveform to the square waveform and sends it to IC4 (1/128 by IC4 becomes 3.7 Hz signal and is supplied to X13 (SAMPLING PULSE).



A.L 12V 144
12
SW X4
Capstan pick-up head
61
5
AMP X8, X9
6
TRAPEZOID X10, X11
7
PHASE DET X12
Comparison signal
8
SAMPLING HOLD X14
Reference signal
4
SAMPLING PULSE X13
(PHASE ERROR)
3
16
COUNT DOWN
13
IC4 (1/128)
1
8
2
SCHMITT TRIGGER X17, X18
1
OSC X15, X16
TFC 475.2Hz
R74
CAP. SAMPLING POSITION
R115
18V
9
8
IC5
DISCRI AMP
CAPSTAN MOTOR
M
101
6
5
7
4
10
M·D·A X23, X2
R114
R76
CAPSTAN DISCRI
11
MOTOR CTL IN 51
(from MECHACON 31)
MOTOR CONTROL X19, X21

Fig. 3-36 Block diagram of capstan servo

This reference signal is supplied to X12 (PHASE DETECTOR).

Regarding the relative signal on the other hand, the capstan pick-up head picks up the rotations of two magnets inlaid in the capstan flywheel and generates pulse, which is amplified by X8, X9 (AMPLIFIER) to be supplied to X10, X11 (TRAPEZOID). In this condition the trapezoid circuit generates trapezoidal waveform (sawtooth waveform in actual) signal to send it to X12 (PHASE DETECTOR). The signal is the so-called the relative signal.

There is error voltage generated at the phase detector (PHASE DET) by comparing both phases of the relative signal and reference signal, and the error voltage is supplied to X14 (SAMPLING HOLD) to be able to hold the voltage.

The error voltage generated in the above manner passes through the discriminator amplifier of the discriminator control system and M.D.A. (motor drive amplifier), then reaches the capstan motor.

However, the control is impossible only by the phase control system under the circumstance of large frequency variation at starting and so forth. In the case of making loop gain large, there arises so-called hunting phenomenon of too much servo effect. Therefore it is required to set the discriminator control system for damping.

The discriminator control system is composed of the discriminator amplifier (IC-5) and M.D.A. (X23, X2). This system controls frequency variation at starting and in large variation to make the rotation constant.

3-3-4 Reference signal generating circuit

This circuit generates the reference signal for the phase control system.

1. OSCILLATOR [1]

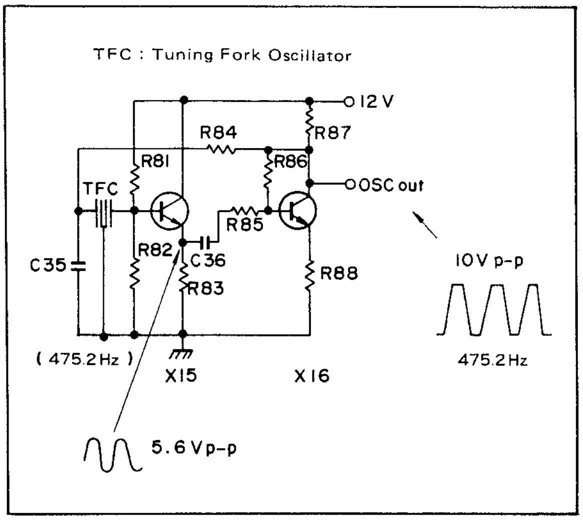


Fig. 3-37 Tuning fork oscillator

Refer to Fig. 3-37.

The oscillator utilizes a piezoelectric tuning fork (TFC-type). The oscillation whose phase has been shifted by 180° by X16 is sent to TFC input through R84, however, at TFC output the oscillation becomes positive feed-back since it is converted again between the input and output of TFC.

2. SCHMITT TRIGGER [2] – X17, X18

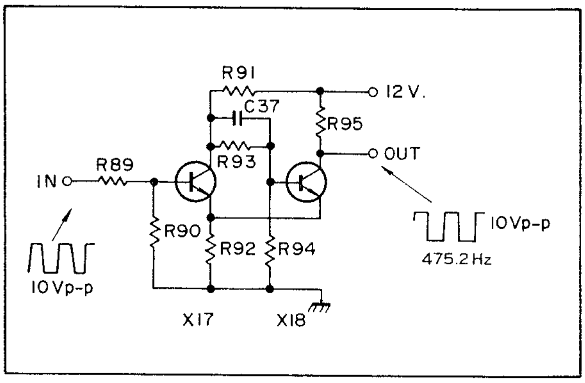


Fig. 3-38 Schmitt trigger

Refer to Fig. 3-38.

As the parts of rise and fall of the signal picked up by the collector of X16 are blunt, the waveform is reformed by the Schmitt trigger circuit so that the rise and fall may be sharp. For, there is a fear to make a miscount if the signal is sent to the Count-Down (IC) leaving the waveform as it is.

3. COUNT-DOWN [3] –IC4

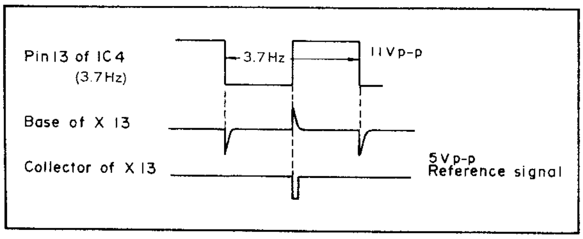


Fig. 3-39 Timing chart

Refer to Fig. 3-39.

The Schmitt trigger output is counted down to 1/128 by this IC4. The signal coming through the pin 1 of IC4 is made counted down to 1/16, then supplied to the pin 10 of IC4. Finally, the signal is counted down to 1/128 then picked up through the pin 13 of IC4.

4. SAMPLING PULSE [4] –X13

As shown in the Fig. 3-39, the signal, counted down to 1/128 is supplied to the base of X13 after it is differentiated by C38 and R97. Consequently, X13 turns on as it receives positive pulse and then the collector potential will be reduced to 0 V (approx.). This voltage will be supplied to X12 (PHASE DETECTOR) as the reference signal.

The above is explained on the reference signal generating circuit of the capstan servo system.

The circuit takes the same operating both in recording and playback.

3-3-5 Relative signal generating circuit

The relative signal generates being supplied with pulse obtained through the capstan pick-up head.

1. PULSE AMPLIFIER [5] – X8, X9

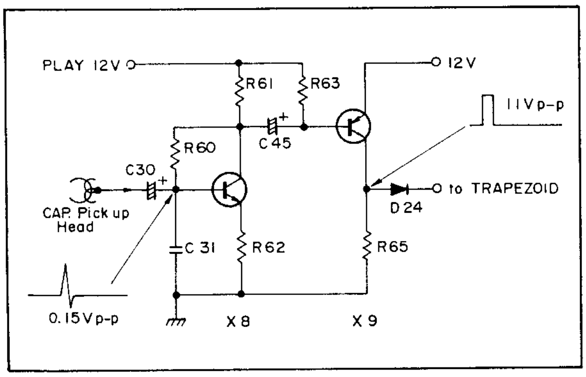

PLAY 12V
R61
R63
12V
11Vp-p
R60
C45
C30
CAP. Pick up Head
D24
to TRAPEZOID
C31
R62
R65
0.15Vp-p
X8
X9

Fig. 3-40 Pulse amplifier

In recording and playback, the circuit acts as a pulse amplifier. However, in Fast-Forwar/Rewind mode, X9 remains turned on and the collector of X9 supplies 11 V DC since "PLAY IN" 12 V DC is not supplied in this mode.

2. TRAPEZOID [6] –X10, X11

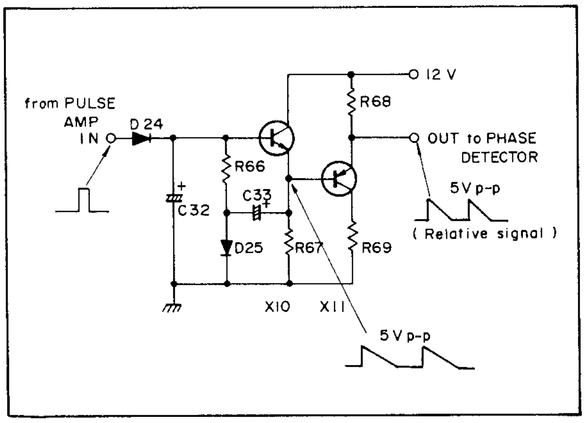

12 V
from PULSE AMP IN
D24
R68
OUT to PHASE DETECTOR
R66
5V p-p
C33
C32
D25
R67
R69
(Relative signal)
X10
X11
5V p-p

Fig. 3-41 Trapezoid

Transistor X10 generates the saw-tooth waveform of good linearity utilizing the bootstrap circuit.

Transistor X11 is an emitter follower which provides a low impedance.

This saw-tooth waveform is supplied to X12 (PHASE DETECTOR) as the relative signal.

3-3-6 Phase comparing circuit

In this circuit phase comparing between the reference signal and the relative signal is made in order to generate the error voltage and to hold it.

1. PHASE DETECTOR [7]. SAMPLING HOLD [8]

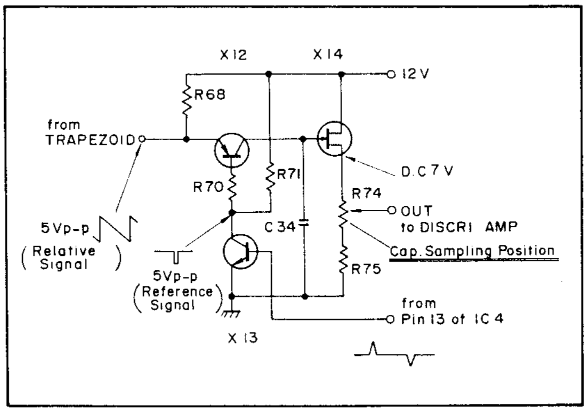

X12
X14
12V
R68
from TRAPEZOID
D.C 7V
R71
R70
R74
OUT to DISCRI AMP
5Vp-p
C34
(Relative Signal)
Cap. Sampling Position
R75
5Vp-p (Reference Signal)
from Pin 13 of IC 4
X13

Fig. 3-42 Phase detector

Both the relative signal of saw-tooth waveform to the emitter of X12 and the reference signal supplies the base of X13. When the reference pulse supplies the base of X12. In this time, X12 turns on, so that the emitter potential of X12 is picked up by the collector of X12 to charge C34.

As X14 is S.F. (Source Follower) utilizing FET and its impedance on the gate side is very high, so that the potential charging C34 is held. At the period of normal phase, 7 V DC is picked up at the source of X14 and the voltage is supplied to the discriminator amplifier as a phase error voltage.

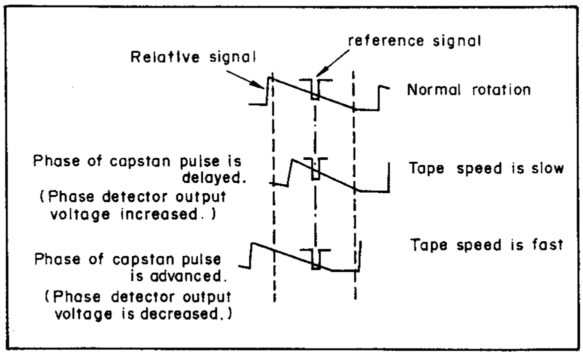

Relative signal
reference signal
Normal rotation
Phase of capstan pulse is delayed.
(Phase detector output voltage increased.)
Tape speed is slow
Phase of capstan pulse is advanced.
(Phase detector output voltage is decreased.)
Tape speed is fast

Fig. 3-43 Phase detector output

3-7-7 Discriminator control system (DISCRIMINATOR AMPLIFIER [9], MOTOR DRIVE AMPLIFIER [10])

As described in 3-3-3 previously, there is the necessity of the discriminator control system for damping against large variation or at starting operation.

The discriminator generally acts in converting frequency variation to voltage variation.

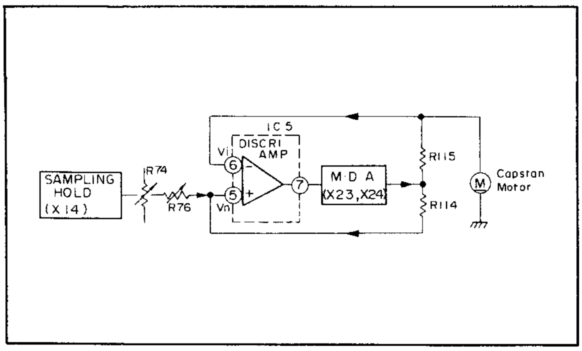

SAMPLING HOLD (X 14)
R74
R76
IC 5
DISCRI AMP
Vi
Vn
6
5
7
M D A
X23, X24
R115
R114
Capstan Motor
M

Fig. 3-44 Discriminator control circuit

Its operational principle is as follows:

Output voltage of X14 (SAMPLING HOLD) is supplied to Vn (non-invertor) of the discriminator amplifier through R74 and R76. On the other hand the output of the motor drive amplifier is supplied through R115 to Vi (invertor). By amplifying the potential difference between the two output voltages at IC5 (DISCRIMINATOR AMPLIFIER) and converting its impedance by the motor drive amplifier, the necessary output to rotate the capstan motor is obtained.

In the case, the rotation frequency of the motor decreases, the current being supplied to the motor is increased through R115 and the potential of Vi decreases. If so, the discriminator amplifier detects this phenomenon and generates higher voltage, which is supplied to the motor through the motor drive amplifier to increase rotation frequency.

3-3-8 Tape speed

This unit has no circuits to adjust tape travelling speed such as by a variable resistor. In this unit the tape travelling speed is determined by the frequency from the TFC oscillator.

3-3-9 Capstan motor control [11] – X19, X20, X21

When high voltage is supplied from the mechanism control circuit to this circuit, X19 turns on and its collector potential becomes low (nearly 0 V). Accordingly, X20 and X21 turn off so that the output of IC5 appears on both the capstan side and the drum side to rotate the motor respectively.

When low voltage is supplied to the terminal (51), X19 turns off while X20 and X21 turn on. Then the collector potentials of the transistors are nearly grounded. As a result, the motor drive amplifier (X23, X2) turns off and the capstan motor does not rotate.

At the same time the motor drive amplifier (X22, X1) of the drum side also turns off, so the drum motor does not rotate. In the case the mechanism control functions in the Auto Stop mode, the potential of the motor control input becomes low and the capstan and the drum motor stop.

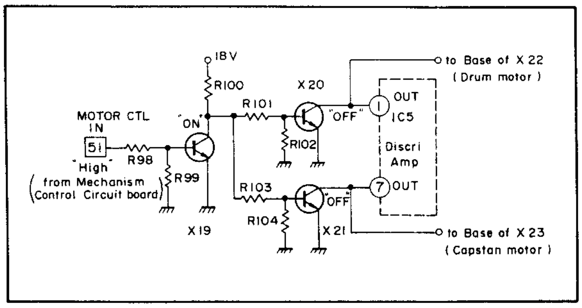

18V
R100
X20
R101
MOTOR CTL IN
"ON"
51
"High" R98
(from Mechanism Control Circuit board)
R99
X19
R102
"OFF"
R103
R104
X21
"OFF"
1 OUT
IC5
Discri Amp
7 OUT
to Base of X 22 (Drum motor)
to Base of X 23 (Capstan motor)

Fig. 3-45 Capstan motor control circuit

3-3-10 Electronic switch (SW) [12] – X4

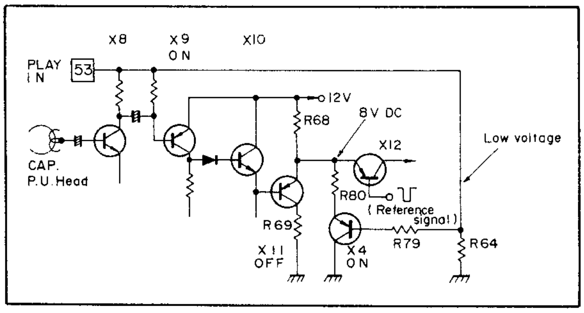

X8
X9 ON
X10
PLAY IN
53
CAP. P.U. Head
12V
R68
8V DC
X12
Low voltage
R80
(Reference signal)
R69
X11 OFF
X4 ON
R79
R64

Fig. 3-46 Electronic switch (X4)

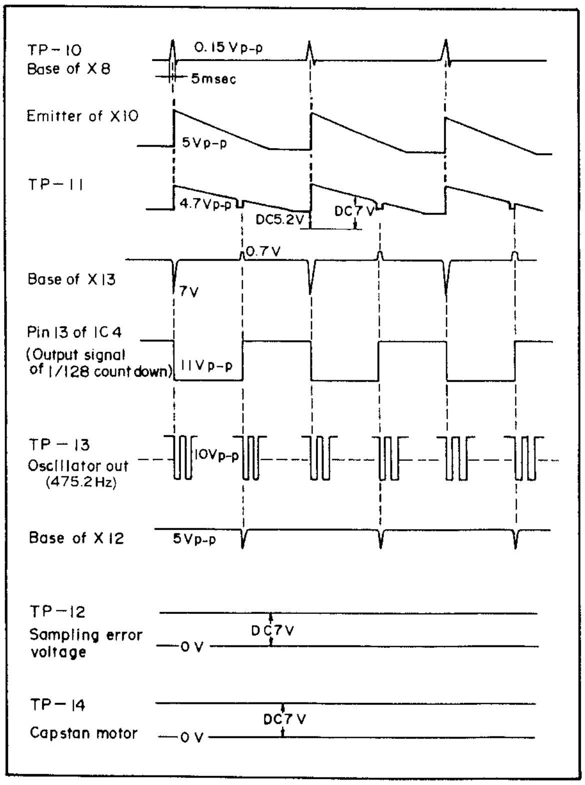


Fig. 3-47 Capstan servo timing chart

In Rewind or Fast-forward mode, the terminal (53) PLAY INPUT is charged with low voltage. Consequently, X4 is on and the amplifier (X8, X9) does not operate.
On the other hand, X9 is on, X10 is on and X11 is off in the condition, so the emitter of X12 (PHASE DETECTOR) is impressed by the fixed bias (8 V DC approx.) divided by R68 and R80.
If the sampling pulse supplies to the base of X12 the output will hold the constant potential.
In other words, in Fast-Forward/Rewind mode the loop of the phase control system is not operating and constant phase error voltage is generated to rotate the motor.

3-3-11 Drum servo system

The drum servo system, in record mode, causes the video heads to rotate at precisely 25 Hz, that is, at one-half of the vertical sync frequency. Therefore, the channel-1 (CH-1) video head scans one field and the channel-2 (CH-2) video head scans the succeeding field. In addition, the drum servo system regulates the relative positions of the video heads and tape to keep the vertical blanking period consistently recorded along the bottom portion of the video tracks. Thus, a fixed switching point will appear at the bottom of the TV screen in playback. The pattern of the video tracks, control track and audio tracks recorded under normal conditions is shown in Fig. 3-48 below. All vertical sync signals are recorded in the beginning portion of the video tracks. In the one field-per-track system of the two-head "VHS", frequency modulated video signals are generally recorded as overlapped (that is, a small portion of the field is recorded by both heads) so that, in playback, a loss of signal does not occur at switching point. The switching points are made inconspicuous by placing them at the bottom of the TV screen. This drum servo system as well as the capstan servo system is composed of the phase control system and the discriminator control system. For the reference signal of the phase control system is vertical sync signal of input video signal in recording and the control signal recorded on the control track in playback.

On the other hand, the relative signal to control drum rotation is made by phase comparing of the above reference signal and the phase of drum rotation picked up by the drum pick-up head. The discriminator control system functions against large variation to make rotation constant while the phase control system controls video head drum rotation to be constant against smaller variation. The purpose of the playback servo system is to make the rotating heads trace the recorded video tracks accurately. This permits accurate reproduction of the video signals recorded on the tape. Servo control also provides a damping effect to prevent the head from rotating erratically. If erratic rotation of the heads occurs during recording, line-to-line horizontal time-base instability would result. In playback, therefore, jitter would appear in the picture.

3-3-12 Drum servo system block diagram

A) Record drum servo system

Refer to Fig. 3-60 "Block diagram of drum servo system". The reference signal of the phase control system of the record drum servo system is the input video signal which is supplied from the luminance and colour (Y/C) circuit board. This video signal is first amplified by the VIDEO AMPLIFIER [13], then supplied to SYNC SEPARATOR [14], which picks up composite sync signal. This composite sync signal is supplied to the luminance and colour(Y/C) circuit board as a sync output. And also supplies to low-pass-filter (L.P.F.) [15]. The low-pass-filter and the vertical sync separator (V. SYNC SEP. [16]) rejects the horizontal sync signal from the composite sync signal. Then the 50-Hz vertical sync pulse is sent to a monostable multivibrator functions as a 2:1 frequency divider, so that the 25 Hz pulse train supplied to the OUTPUT [18]. Then this signal is supplied to the control head as a control signal.
The other hand, this 25 Hz signal is amplified by the AMPLIFIER [19] and [20] (CONTROL AMPLIFIER), then supplied to the MONOSTABLE MULTIVIBRATOR [20] (should be adjusted for the correct

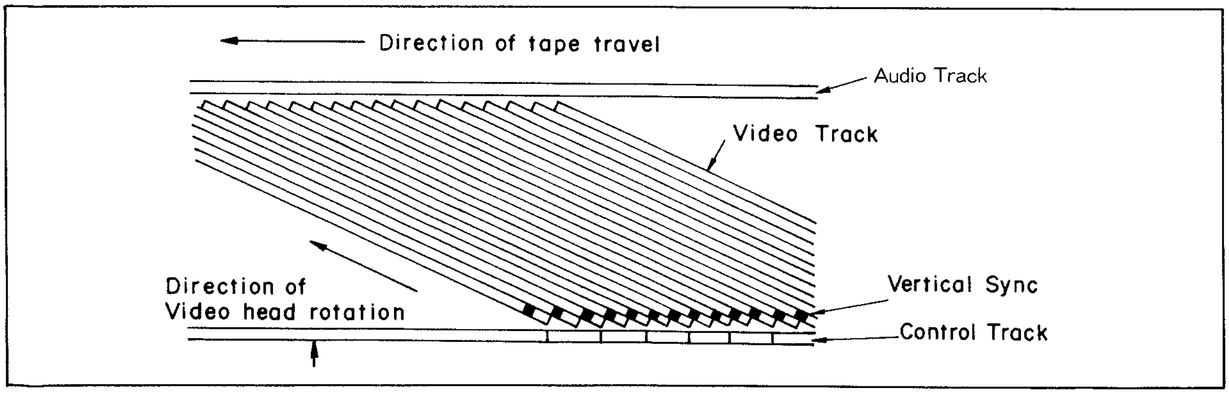


Fig. 3-48 Video tape pattern

switching point during recording) is then sent to the SAMPLING[13] as the reference signal of the phase control circuit.

On the other hand, the relative signal of the phase control circuit is a train of drum pulses, which is induced by the rotation of the two permanent magnets on the upper drum to a pick-up head. This signal is fed to pair of the monostable multivibrators (MONO. MULTI. [24] [25]) after passing through the AMPLIFIER [23], then supplied to the FLIP-FLOP [26]. The output of the flip-flop, which is a 25-Hz square wave, is supplied to the luminance and colour (Y/C) circuit board, the mechanism control circuit board and also supplied to the record inverter (REC INV [27]). This signal is further more supplied to the monostable multivibrator (MONO MULTI [28]) and inverter (INV. [29]), then finally supplied to TRAPEZOID [30] (trapezoidal waveform generator). The waveform is then sent to the SAMPLING [31]. This trapezoidal waveform is called the relative signal of the phase control circuit.

At the SAMPLING HOLD [31], the relative signal (trapezoidal waveform) is sampled by the reference signal from the OUTPUT [22], and the sampling error voltage corresponding to the phase difference between two signals is generated. At this sampling error voltage is detected according to the pulse train of the reference signal, so that this sampling error voltage will be held to next sampling then supplied to the NON-LINEAR [32]. Then this signal is supplied to the LIMITER [33] where the voltage is controlled to be in the specified range, then supplied to SOURCE FOLLOWER [34], from where it is supplied to the discriminator servo system as the phase error voltage. However, large frequency variations caused at starting, or other large changes in tape speed, cannot be controlled by the phase control circuit alone. If loop gain is increased only by the phase control circuit, "hunting" phenomena will occur. To resolve this problem, discrimination control should be done through the damping system. This is the discriminator servo system. The discriminator servo system has a circuit the same as that of the capstan servo system, which is composed of DISCRIMINATOR AMPLIFIER [9] and MOTOR DRIVE AMPLIFIER [35]. It makes rotation of the motor constant corresponding to the phase error of the phase control system.

B) Playback drum servo system

The reference signal of the phase control system of the playback drum servo system is the control signal recorded on the control head and amplified by the AMPLIFIER [19] [20], then supplied to the monostable multivibrator (MONO. MULTI. [21]) and the SAMPLING [31].

The relative signal of the phase control system is same as the record mode. Only difference, phase of the monostable multivibrator and the time constant of the trapezoidal waveform generator are changed.

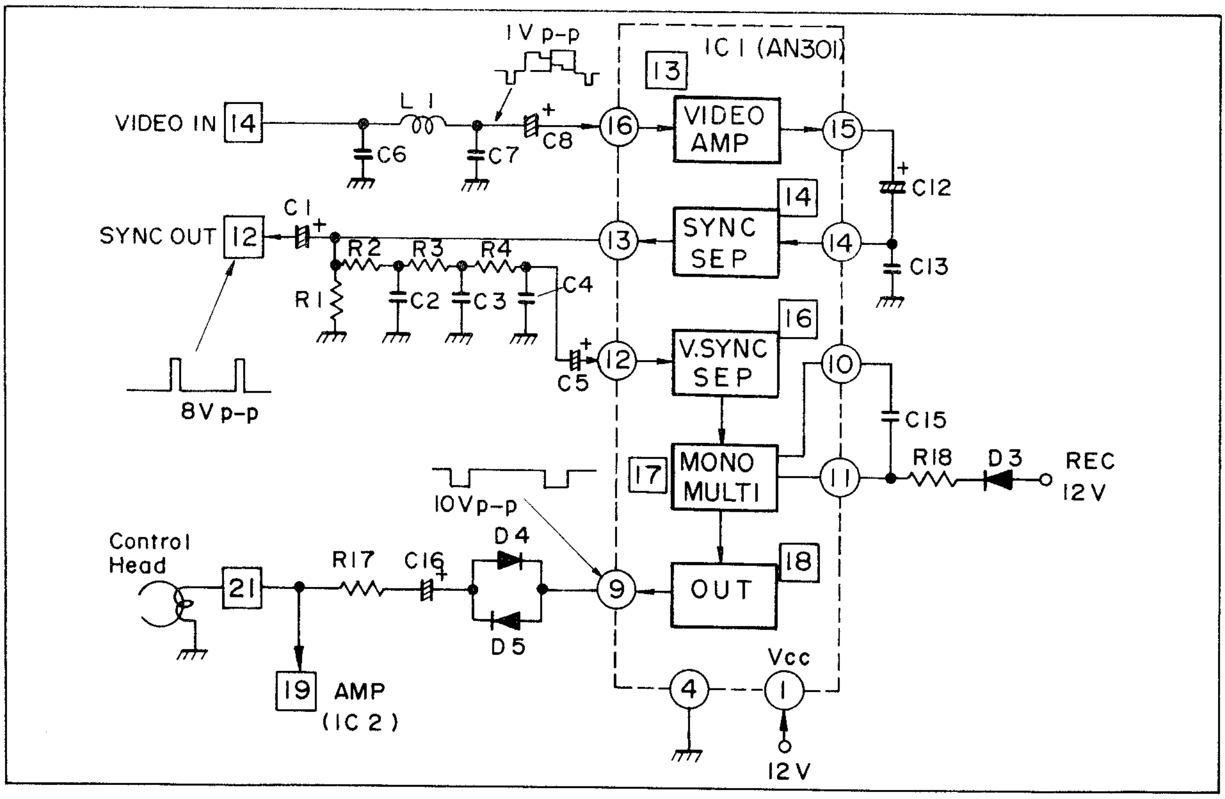


Fig. 3-49 Integrated circuit-1

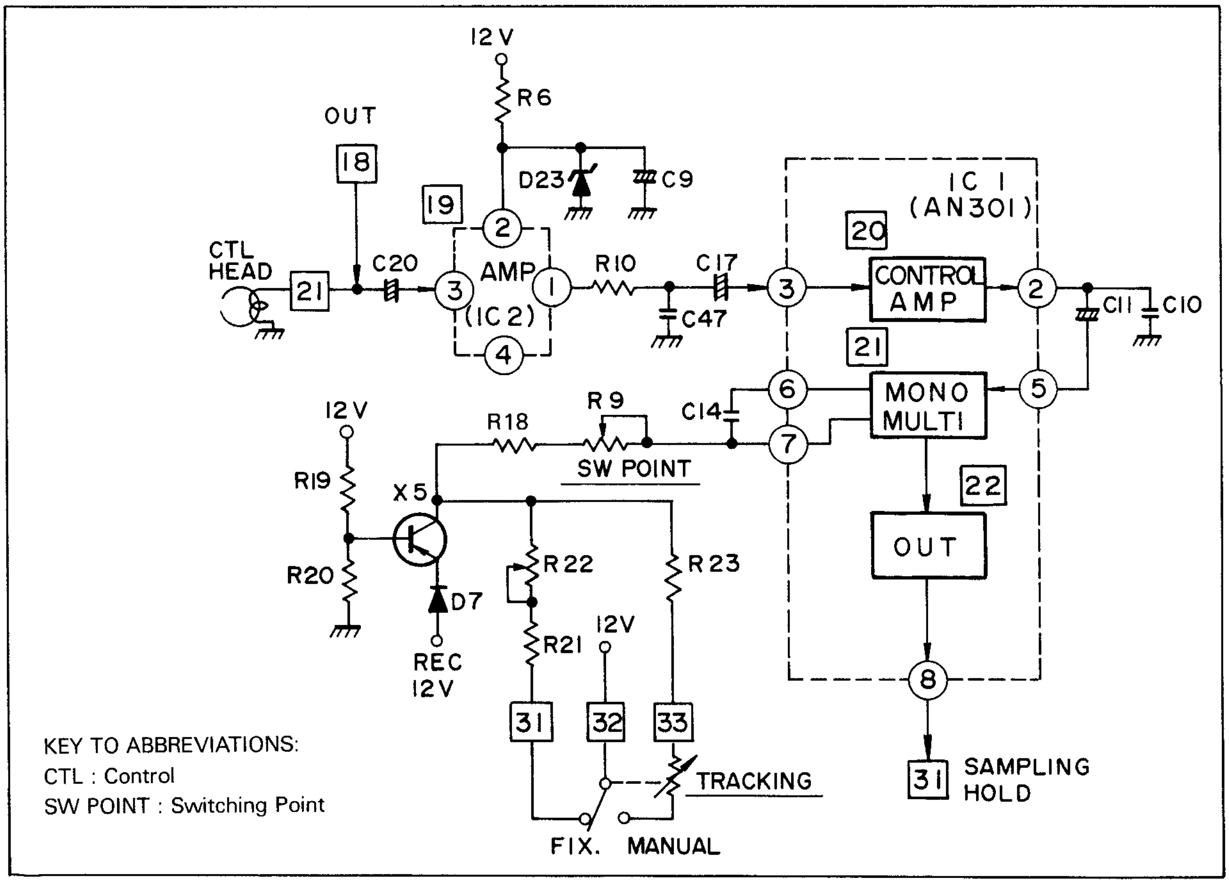
3-3-13 Theory of drum servo system

1. VIDEO AMPLIFIER[13], SYNC SEPARATOR[14], LOW-PASS FILTER[15], VERTICAL SYNC SEPARATOR [16], MONOSTABLE MULTIVIBRATOR [17], OUT[18]

In recording, the video signal whose colour element has been eliminated by the low-pass filter composed of C6, C7 and L1 is first supplied to the VIDEO AMPLIFIER [13] to be amplified. After that the signal is supplied to the SYNC SEPARATOR[14], the composite sync signal is stripped from the input video signal of the sync separator. The L.P.F. (low-pass filter)[15] consisting of R1–R4 and C2–C4, attenuates the horizontal sync component of the composite sync signal and supplies it to the VERTICAL SYNC SEPARATOR[16] which sends the 50-Hz vertical sync signal to other points. The 50-Hz vertical sync signal is converted into 25-Hz pulse train by the MONOSTABLE MULTIVIBRATOR[17]. Time constant for this operation is decided by C15 and R8. The signal which passed the monostable multivibrator is supplied in two ways through the OUTPUT[18]; one is supplied to the control head and recorded as the control pulse on a tape, while the other to the AMPLIFIER (IC2) [19]. D4 and D5 are set for eliminating noise especially in playback.

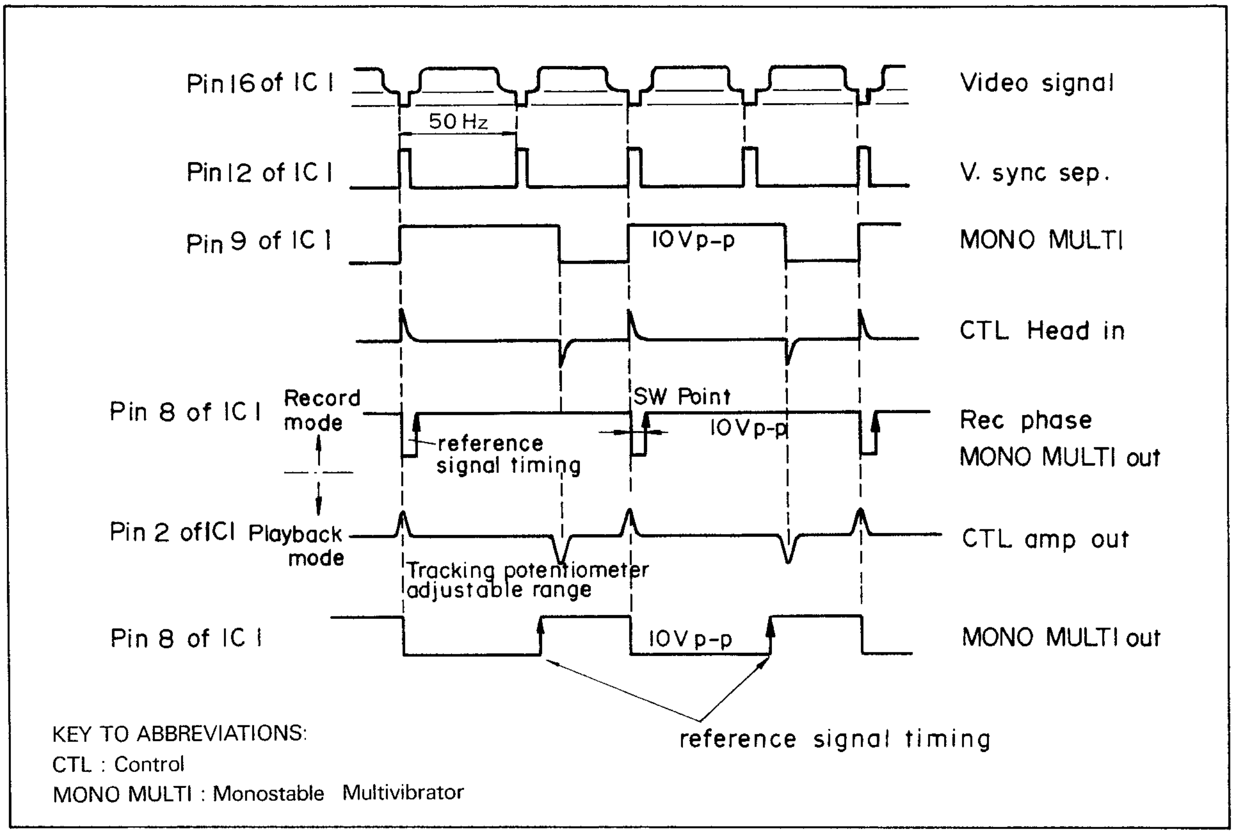
2. AMPLIFIER [19], CONTROL AMPLIFIER [20], MONOSTABLE MULTIVIBRATOR[21], OUTPUT [22], RECORDING SWITCH [36]

In recording, the signal from the OUTPUT [18] is supplied to the AMPLIFIER [19], where it is amplified and after that is supplied to the CONTROL SIGNAL AMPLIFIER [20] in the same phase to the input.
The amplified signal is supplied to the MONOSTABLE MULTIVIBRATOR [21] in the same phase as that of the input.
In recording mode, the SWITCH (recording switch X5) [36] is on and the time constant of the monostable multivibrator is determined by R18, R9 and C14, in other words, the switching point is deciced at this stage. Resistor R9 is a variable resistor which adjusts the switching point.
The output of the monostable multivibrator is supplied through the OUTPUT[22] to the SAMPLING HOLD[31]. This will be the reference signal. In playback mode, the control signal is supplied from the control head, and this signal takes the same circuit to be the reference signal. In this case the time constant of the MONOSTABLE MULTIVIBRATOR [21] is longer than in recording because of tracking.



KEY TO ABBREVIATIONS:
CTL : Control
SW POINT : Switching Point

Fig. 3-50 Record phase monostable multivibrator



KEY TO ABBREVIATIONS:
CTL : Control
MONO MULTI : Monostable Multivibrator

Fig. 3-51 Reference signal timing chart

3. AMPLIFIER [23], MONOSTABLE MULTIVIBRATOR [24], [25], FLIP-FLOP [26]

The drum pulse, source of the relative signal of the phase control system, is picked up in the manner that the drum pick-up head picks up rotation of two magnets inlaid in the drum pulley taking the contrary position each other. Flip-flop output signal is generated in the timing shown in the figure.

Flip-flop output is supplied to the luminance and colour circuit board and the mechanism control circuit board. The output is supplied to the recording INVERTER [27] and the diode switch [37].

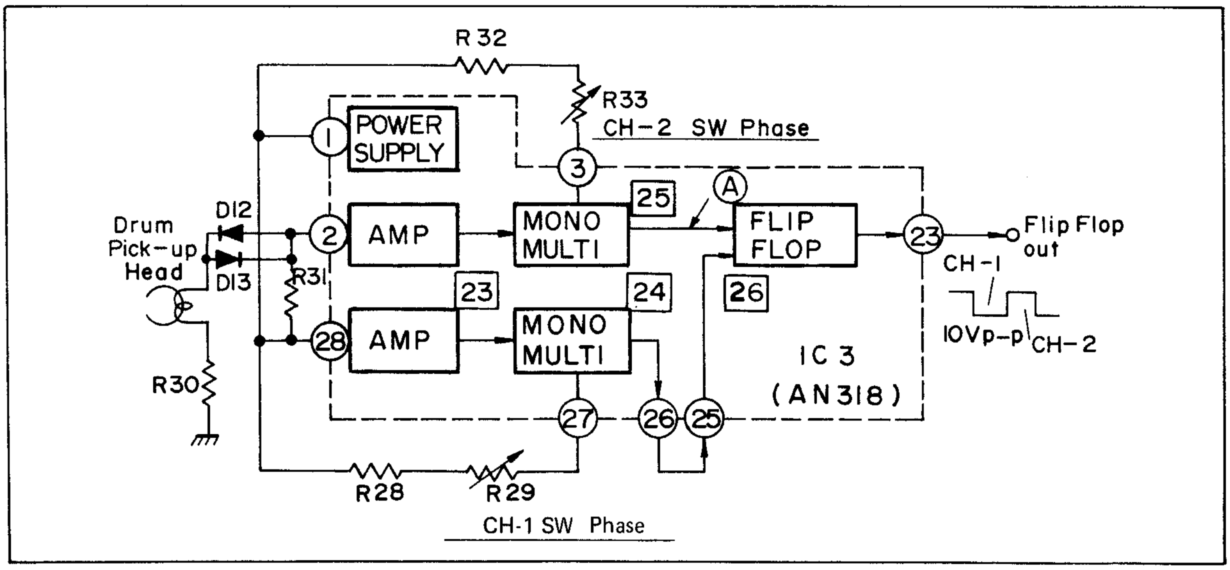

R32
R33
CH-2 SW Phase
1
POWER SUPPLY
3
25
A
Drum Pick-up Head
D12
D13
2
AMP
MONO MULTI
FLIP FLOP
23
Flip Flop out
CH-1
R31
23
24
26
28
AMP
MONO MULTI
10Vp-p
CH-2
IC 3
(AN318)
R30
27
26
25
R28
R29
CH-1 SW Phase

Fig. 3-52 Relative signal generating circuit

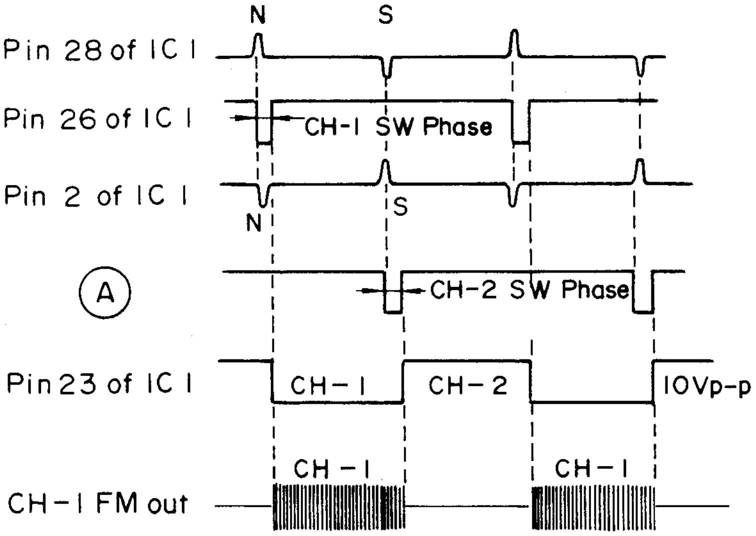


Fig. 3-53 Timing chart

4. RECORD INVERTER [27], DIODE SWITCH [37]

In recording, X6 operates as an inverter since the record 12 V is supplied to the collector of the oscillator X6 through D8. (See Fig. 3-54.)

In playback, X6 does not operate while the play 12 V is impressed to D10 and D11 through R27.

In recording, the flip-flop output is reversed by the inverter X6 and in playback, the same phase of the flip-flop output is supplied to the monostable multivibrator.

5. MONOSTABLE MULTIVIBRATOR[28], INVERTER [29], TRAPEZOIDAL WAVEFORM GENERATOR [30], SAMPLING HOLD[31]

In recording, the signal from the record inverter (X6) is supplied to the MONOSTABLE MULTIVIBRATOR[28]. The output of the monostable multivibrator is supplied to the INVERTER[29], which supplies it to the TRAPEZOIDAL WAVEFORM GENERATOR[30] after reversing it.

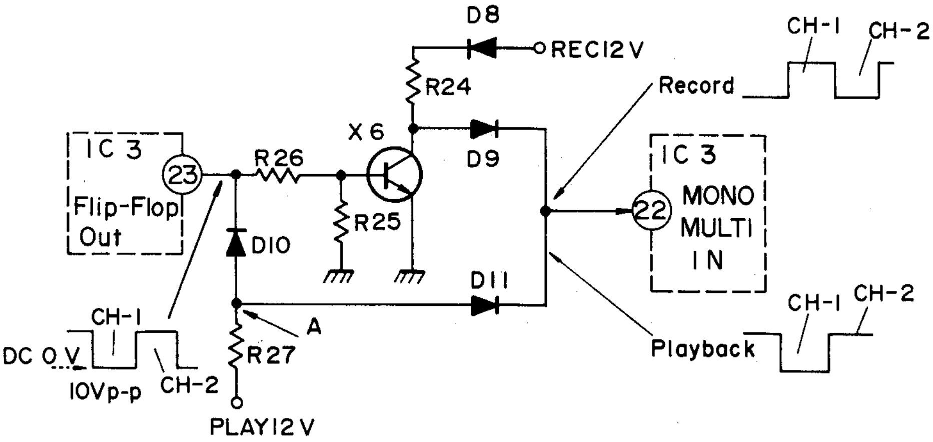
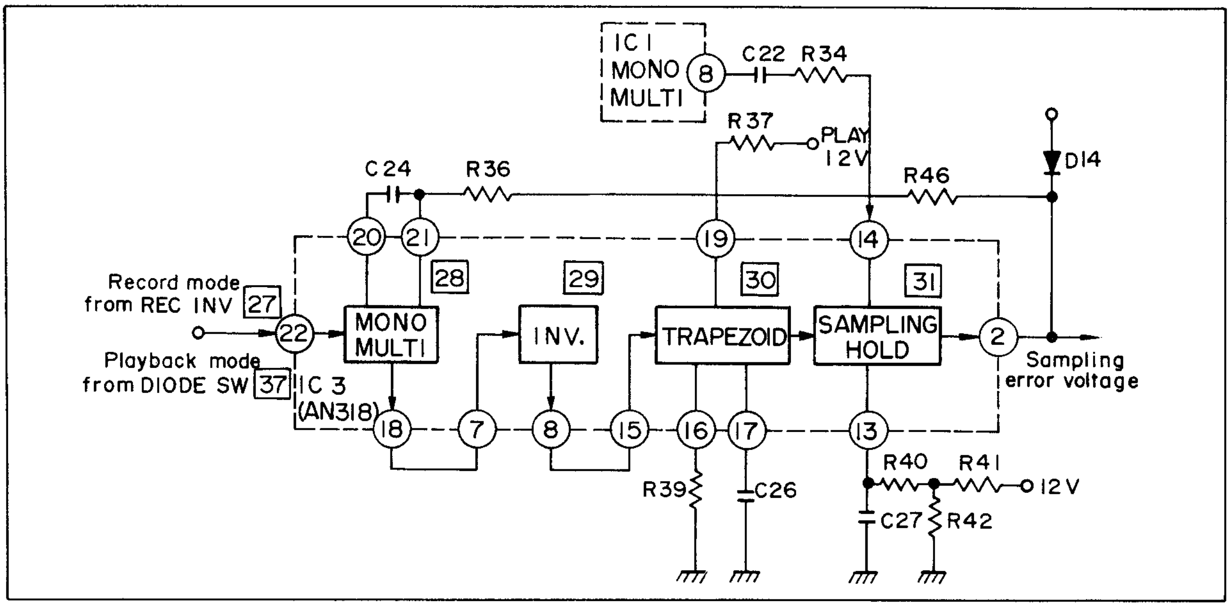

D8
REC12V
R24
X6
D9
IC 3
Flip-Flop
Out
23
R26
R25
D10
D11
A
R27
PLAY12V
CH-1
DC 0 V
10Vp-p
CH-2
Record
CH-I
CH-2
IC 3
22
MONO
MULTI
IN
Playback
CH-I
CH-2

Fig. 3-54 Record inverter and diode switch



IC1 MONO MULTI
8
C22
R34
R37
PLAY 12V
D14
C24
R36
R46
20
21
19
14
Record mode from REC INV 27
28
29
30
31
22
MONO MULTI
INV.
TRAPEZOID
SAMPLING HOLD
2
Playback mode from DIODE SW 37
IC 3 (AN318)
Sampling error voltage
18
7
8
15
16
17
13
R40
R41
12V
R39
C26
C27
R42

Fig. 3-55 Phase comparing circuit

At the TRAPEZOIDAL WAVEFORM GENERATOR [30] a trapezoidal waveform is generated, which will be supplied to the SAMPLING HOLD [31] as the relative signal. The time constant of the part of the slope of the trapezoidal waveform is determined by C26. In playback, the slope becomes more moderate by impression of the play 12 V coming through R37.

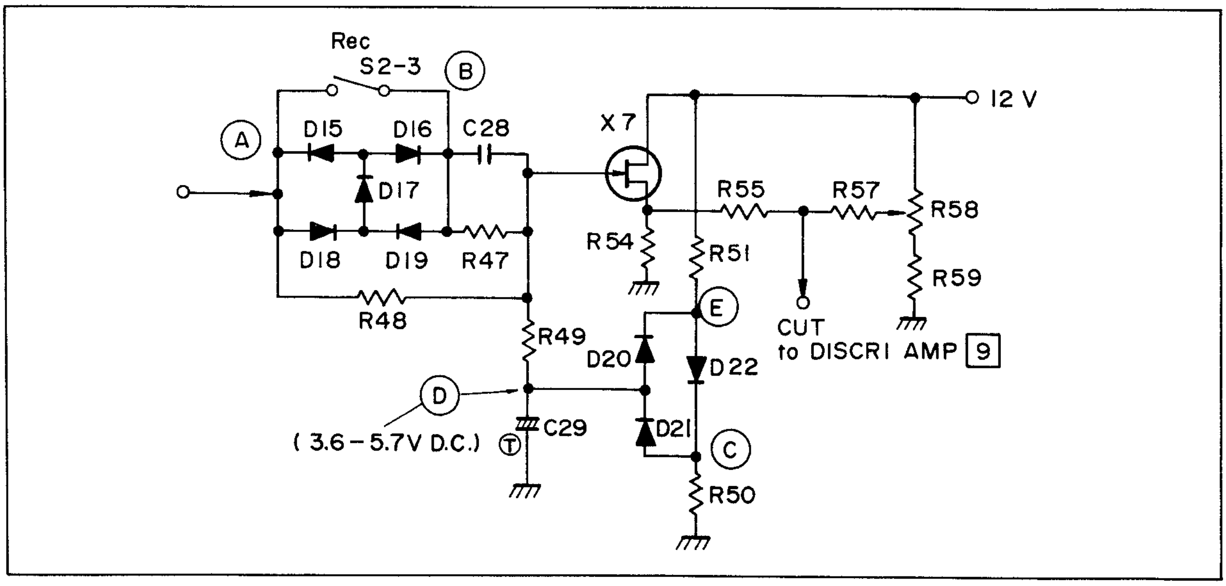
The signal from the output of IC1, monostable multivibrator, namely the reference signal, and it generates sampling error voltage comparing two phases of the relative signal and the reference signal. The generated error voltage is supplied to next NON-LINEAR [32].

C27 is the capacitor to hold the error voltage.

The potential nearly half of 12 V DC power supply coming through R40 is the load to be utilized to prevent the time of servo locking from delaying, for the sampling error is "0" at starting of the motor. The circuit makes the sampling error feed back to the monostable multivibrator and also DC bias is supplied from D14. Consequently, the feedback is made that the sampling error voltage and DC bias are one above another.

6. NON LINEAR [32], LIMITER [33], S.F. [34]

In the recording mode, the NON LINEAR [32] does not operate since the switches S2–3 are closed. Resistors



Rec
S2-3
B
A
D15
D16
C28
X7
12 V
D17
R55
R57
R58
D18
D19
R47
R54
R51
R59
R48
E
R49
D20
D22
CUT
to DISCRI AMP 9
D
C29
(3.6 – 5.7V D.C.)
T
D21
C
R50

Fig. 3-56 Phase error circuit

R47, R49 and capacitors C28, C29 compose the loop filter.

In the playback mode, the switch S2–3 open and the NON LINEAR [32] operates. Since the reference signal to the drum servo is the input video signal in the recording condition, a constant sampling output voltage can be obtained. Accordingly the sampling output in the recording condition is fed to the gate of X7. But in the playback condition, the reference signal is the regenerated control pulse and therefore contains AC ripple components. When the pulse varies with a rapid AC cycle, then the motor rotates in accordance with the cycle, resulting in playback pictures with much jitter.

Assuming that a voltage difference with absolute value of more than the 2.1 volts exists between the intersection of D15 and D18 and that of D16 and D19. When the junction of D15 and D18 is 2.1 volts higher than the junction of D16 and D19, current flows through D18, D17 and D16; and when the former junction is 2.1 volts lower in potential, then current flows through D19 and D17, D15.

On the other hand, when the potential difference is less than 2.1 volts, current can not flow in the same way, and it thus flows only through R48. The limiter circuit prevents the motor from abnormal rotation controlling the phase error voltage within the definite range. The potential at the junction of D21 and D22 (C) is approx. 4.3 volts. If the potential at the junction of R49 and C29 (D) is 0.7 volts lower than the junction of D21 and D22 (C), D21 turns on and the current through D21 to increase the potential at (D).

On the contrary, if the potential at (D) is higher than 5.7 volts DC, the current through D20 will decrease the potential at (D).

Namely, the minimum potential at point "D" is 3.6 volts DC and the maximum is 5.7 volts and the potential does not become out of the range.

According to the above operation of the limiter, the phase error voltage does not become abnormal, which means that the rotation of the motor will not be abnormal.

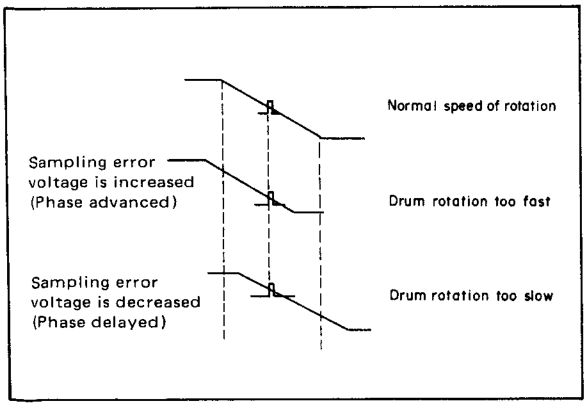

Normal speed of rotation
Sampling error voltage is increased (Phase advanced)
Drum rotation too fast
Sampling error voltage is decreased (Phase delayed)
Drum rotation too slow

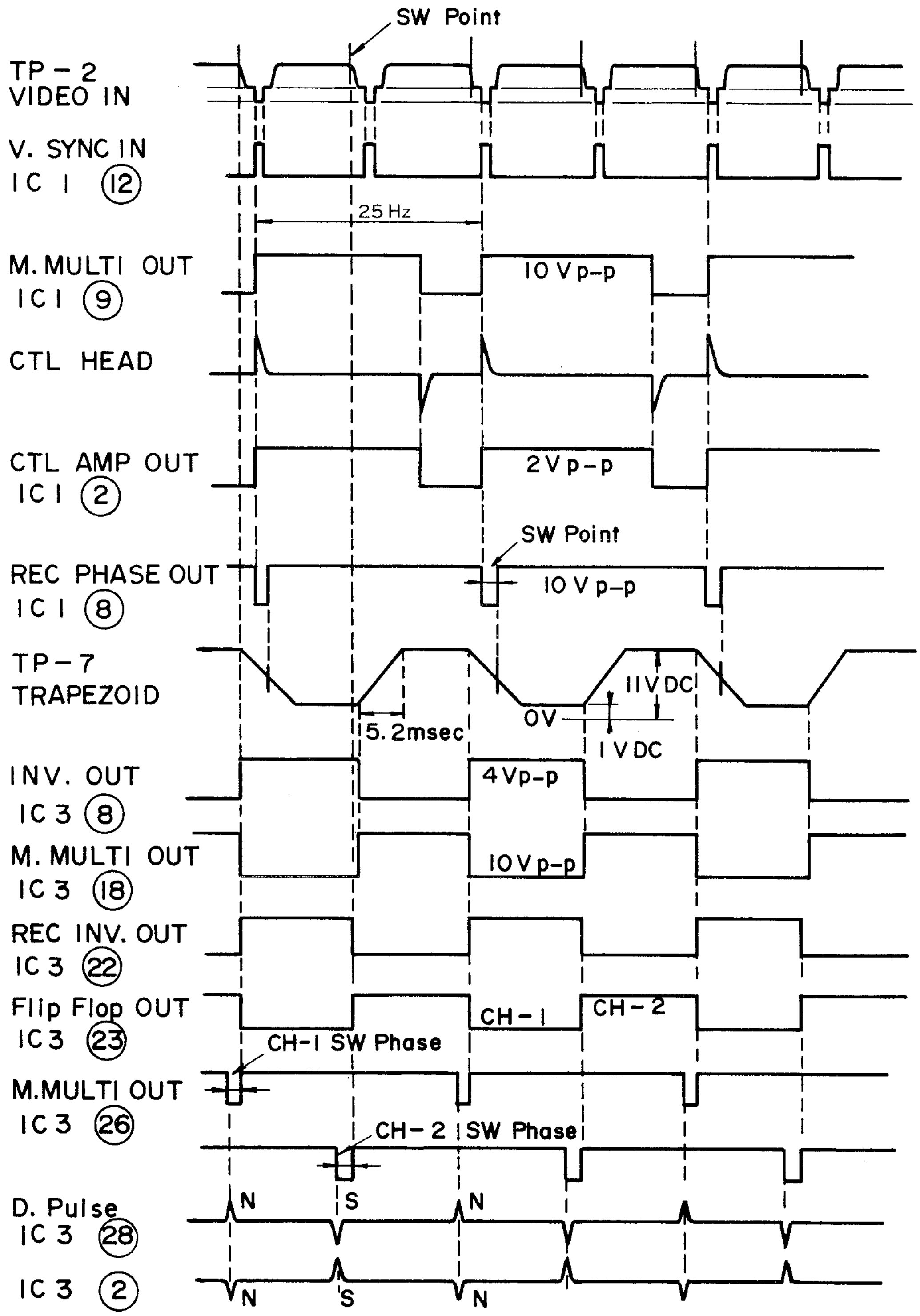
Fig. 3-57 Phase error of the drum servo system

The error voltage which passed through the NON LINEAR [32], and the LIMITER [33], is converted by the impedance at S.F. [34], then will be supplied to the discriminator amplifier of the discriminator control system as the phase error voltage. The signal is finally supplied to the drum motor.

7. DISCRIMINATOR AMPLIFIER [9], MOTOR DRIVE AMPLIFIER [35]

The discriminator control system has the same circuit as that of the capstan servo system, which is composed of the DISCRIMINATOR AMPLIFIER [9] and the MOTOR DRIVE AMPLIFIER [35].

For the operation principle, refer to the section, "Capstan servo system".


SW Point
TP – 2
VIDEO IN
V. SYNC IN
IC 1 ⑫
25 Hz
M. MULTI OUT
IC1 ⑨
10 Vp-p
CTL HEAD
CTL AMP OUT
IC1 ②
2 V p-p
SW Point
REC PHASE OUT
IC 1 ⑧
10 V p-p
TP – 7
TRAPEZOID
11 V DC
0 V
1 V DC
5.2msec
INV. OUT
IC 3 ⑧
4 Vp-p
M. MULTI OUT
IC 3 ⑱
10 V p-p
REC INV. OUT
IC 3 ㉒
Flip Flop OUT
IC3 ㉓
CH – 1
CH – 2
CH-1 SW Phase
M.MULTI OUT
IC3 ㉖
CH – 2 SW Phase
D. Pulse
IC 3 ㉘
N
S
N
IC 3 ②
N
S
N

KET TO ABBREVIATIONS :
CTL : Control D : Drum M. MULTI : Monostable Multivibrator

Fig. 3-58 Drum servo system timing chart (Record mode)

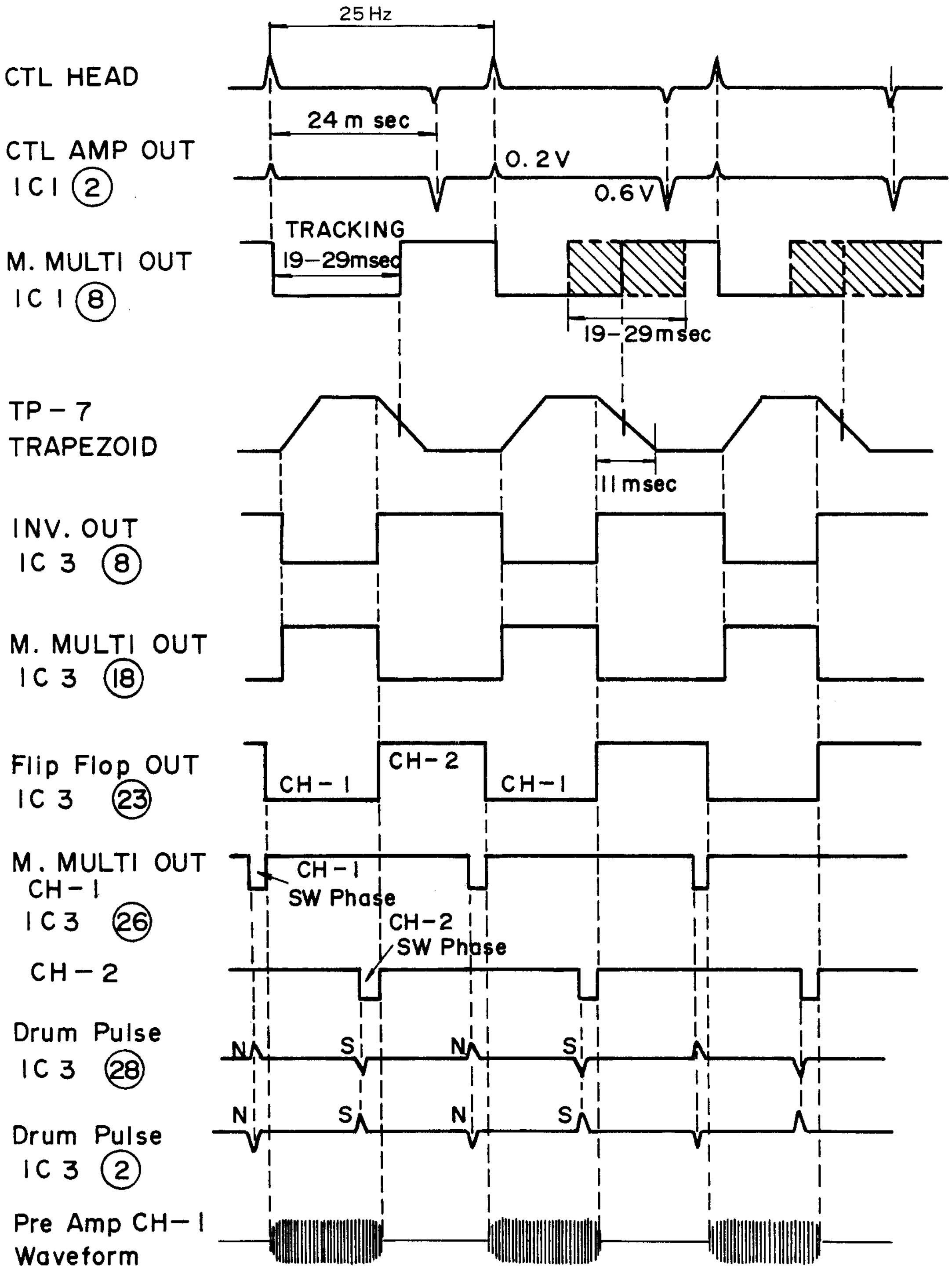

25 Hz
CTL HEAD
24 m sec
CTL AMP OUT
IC1 ②
0.2V
0.6V
TRACKING
19–29msec
M. MULTI OUT
IC1 ⑧
19–29msec
TP–7
TRAPEZOID
11msec
INV. OUT
IC3 ⑧
M. MULTI OUT
IC3 ⑱
Flip Flop OUT
IC3 ㉓
CH–1
CH–2
CH–1
M. MULTI OUT
CH–1
IC3 ㉖
CH–1
SW Phase
CH–2
SW Phase
CH–2
Drum Pulse
IC3 ㉘
N
S
N
S
Drum Pulse
IC3 ②
N
S
N
S
Pre Amp CH–1
Waveform

Fig. 3-59 Drum servo system timing chart (Playback mode)

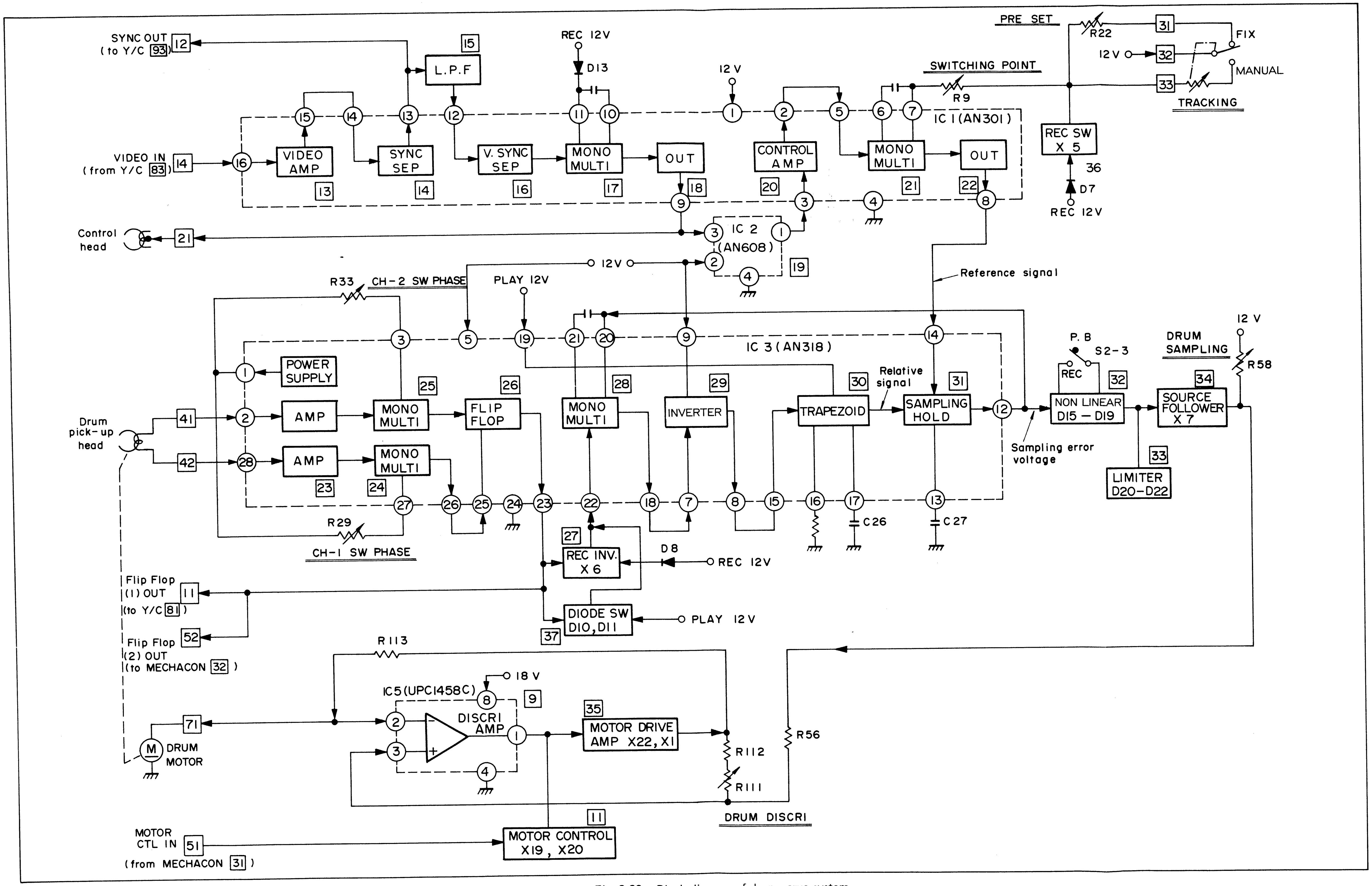

SYNC OUT 12
(to Y/C 93)
VIDEO IN 14
(from Y/C 83)
VIDEO AMP 13
SYNC SEP 14
L.P.F 15
V. SYNC SEP 16
REC 12V
D13
MONO MULTI 17
OUT 18
12 V
CONTROL AMP 20
MONO MULTI 21
OUT 22
IC 1 (AN301)
PRE SET
R22
31
FIX
12 V
32
MANUAL
SWITCHING POINT
R9
33
TRACKING
REC SW X 5
36
D7
REC 12V
Control head
21
IC 2 (AN608)
19
12V
Reference signal
R33
CH-2 SW PHASE
PLAY 12V
IC 3 (AN318)
POWER SUPPLY
Drum pick-up head
41
42
AMP
AMP 23
MONO MULTI 25
MONO MULTI 24
FLIP FLOP 26
MONO MULTI 28
INVERTER 29
TRAPEZOID 30
Relative signal
SAMPLING HOLD 31
Sampling error voltage
C26
C27
R29
CH-1 SW PHASE
REC INV. X 6 27
D8
REC 12V
DIODE SW D10, D11 37
PLAY 12V
P. B
S2-3
REC
NON LINEAR D15 – D19 32
LIMITER D20-D22 33
DRUM SAMPLING
12 V
R58
SOURCE FOLLOWER X 7 34
Flip Flop (1) OUT 11
(to Y/C 81)
Flip Flop (2) OUT 52
(to MECHACON 32)
R113
18 V
IC5 (UPC1458C) 9
DISCRI AMP
MOTOR DRIVE AMP X22, X1 35
R112
R111
R56
DRUM DISCRI
71
M DRUM MOTOR
MOTOR CTL IN 51
(from MECHACON 31)
MOTOR CONTROL X19, X20 11

Fig. 3-60 Block diagram of drum servo system

SECTION 4
DISASSEMBLY

4-1 CHASSIS REMOVAL

1. Remove the two screws ① on the top cover as shown in Fig. 4-1.
   Then lift the top cover.

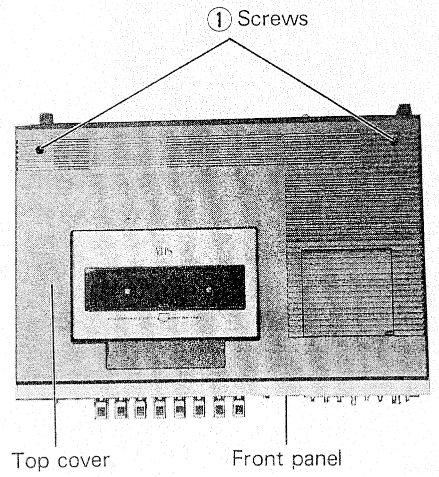

① Screws
Top cover
Front panel

Fig. 4-1

2. Remove the two screws ② and two screws ③ from the side panel.

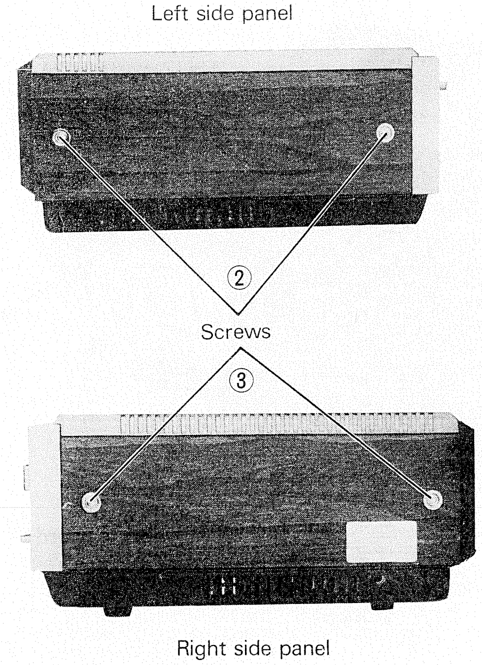

Left side panel
②
Screws
③
Right side panel

Fig. 4-2

3. Remove the six screws ④. Then remove the rear panel.

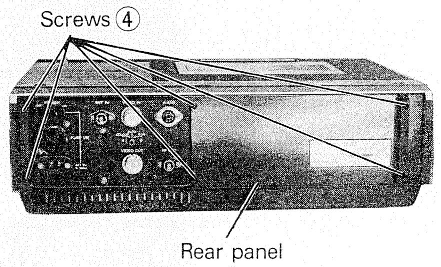

Screws ④
Rear panel

Fig. 4-3

4. Remove the four screws ⑤. Then remove the bottom cover.

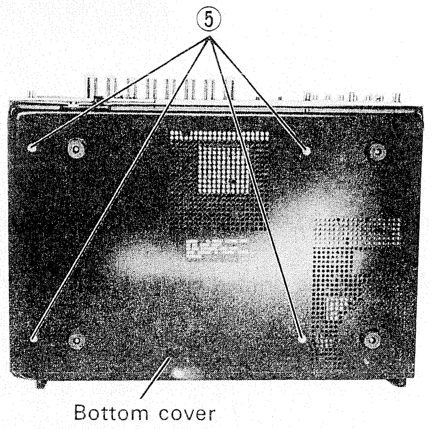

⑤
Bottom cover

Fig. 4-4

5. Remove the two screws ⑥. Loosen screws ⑦ and ⑧, then remove the front panel.

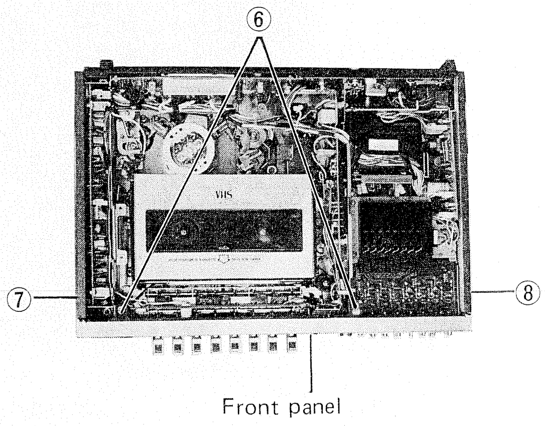

⑥
⑦
⑧
Front panel

Fig. 4-5

6. Remove the four screws ⑨, then remove the cassette housing assembly.

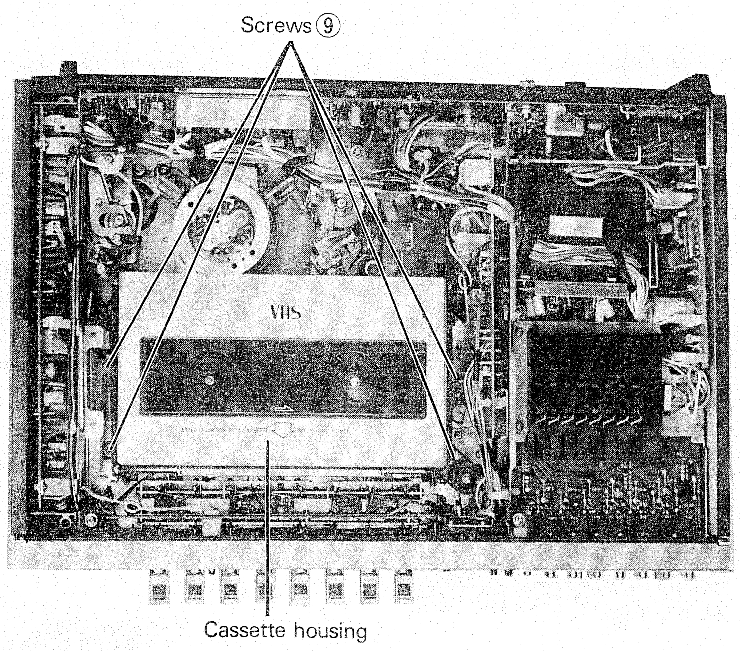

Screws ⑨
VHS
Cassette housing

Fig. 4-6

4-2 REMOVAL OF PRINTED CIRCUIT BOARD

4-2-1 Layout of the printed circuit board

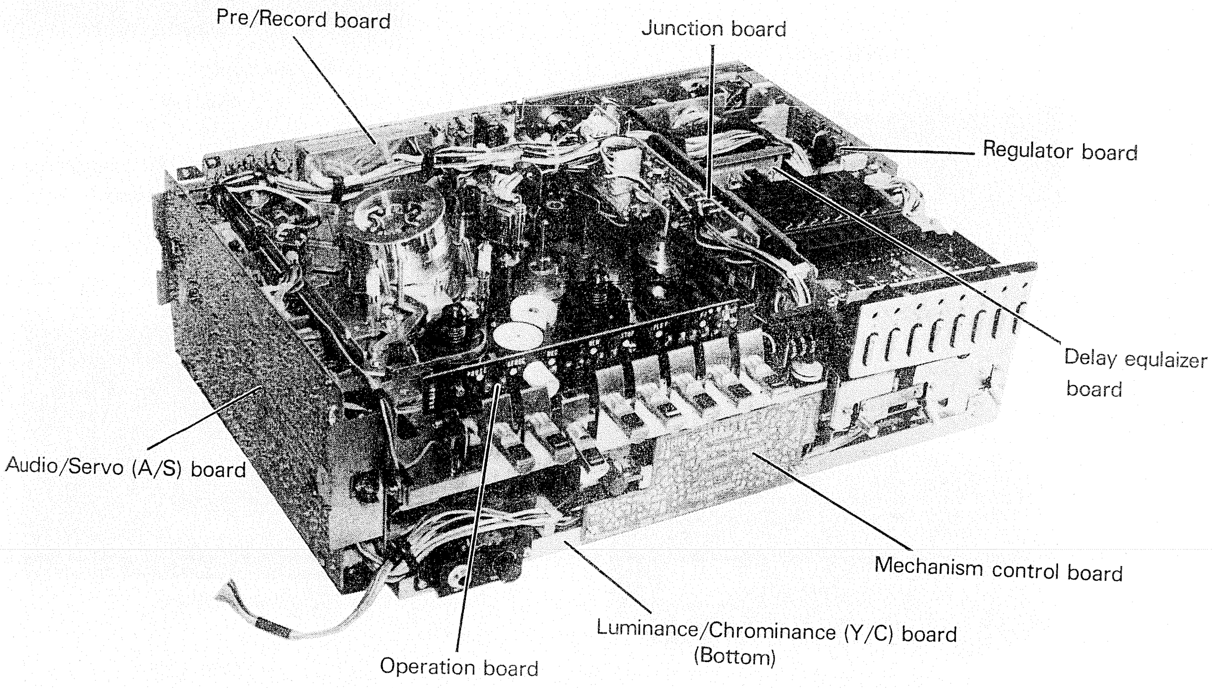

Pre/Record board
Junction board
Regulator board
Delay equlaizer board
Audio/Servo (A/S) board
Mechanism control board
Luminance/Chrominance (Y/C) board (Bottom)
Operation board

Fig. 4-7

4-2-2 Audio/Servo (A/S) printed circuit board

1. Remove the two screws on the printed circuit board as shown in Fig. 4-8.

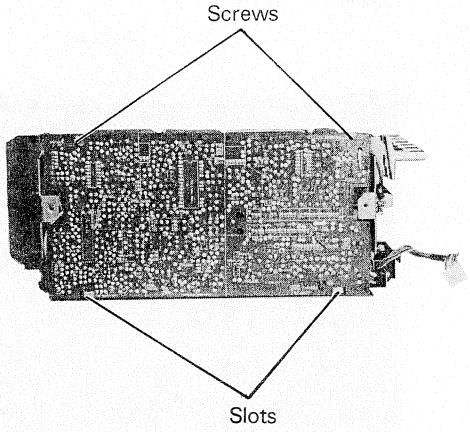


Fig. 4-8

2. Remove the printed circuit board by ensuring that slots are out of chassis and then gently pulling outward.
3. Disconnect the connector from the board.
4. When mounting the Audio/Servo and other printed circuit boards, be sure to connect the correspondingly numbered connectors to the pins on the board.
   Also when mounting the Audio/Servo printed circuit board to the chassis, make sure that the two slide switch activating levers, located near the middle of the printed circuit board, are manually fully leftward, and take care not to pinch the wires when mounting.

4-2-3 Pre/Record (PRE/REC) printed circuit board

1. Remove the four screws on the printed circuit board as shown in Fig. 4-9.

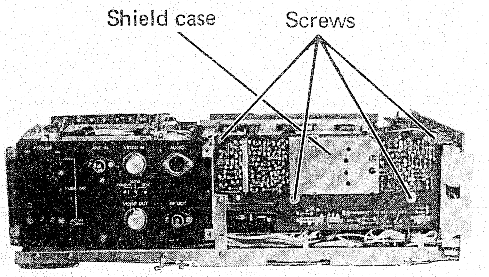


Fig. 4-9

2. Disconnect the numbered connectors on the printed circuit board.
3. Remove the shield case by using a soldering iron, and unsolder the two wires located inside of the shield case as shown in Fig. 4-9.

4-2-4 Luminance/Chrominance (Y/C) printed circuit board

1. Remove the two screws on the printed circuit board as shown in Fig. 4-10.

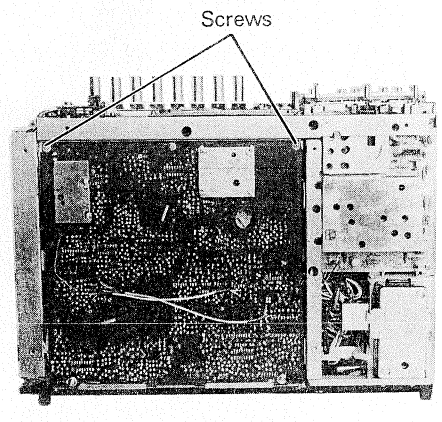


Fig. 4-10

4-2-5 Mechanism control circuit board

1. Remove the two screws on the printed circuit board as shown in Fig. 4-11.

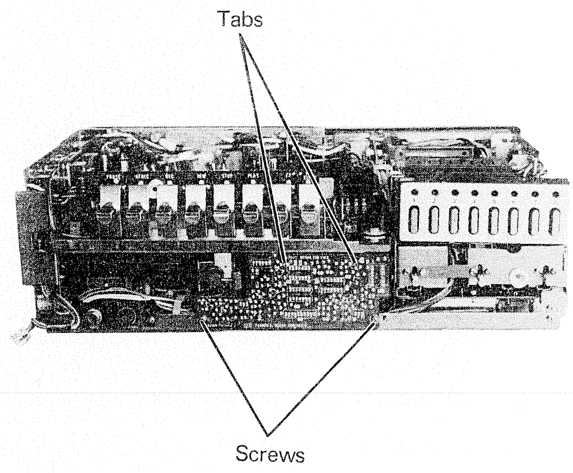


Fig. 4-11

2. Remove the printed circuit board by ensuring that tabs are out of chassis and gently pulling outward.
3. Disconnect the numbered connectors on the printed circuit board.

4-2-6 Regulator printed circuit board

1. Remove the three screws on the printed circuit board as shown in Fig. 4-12.

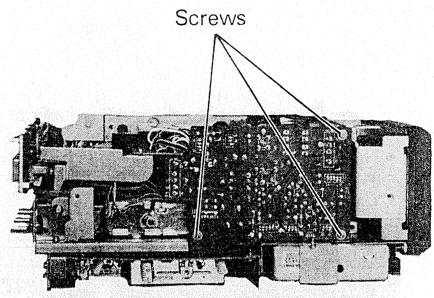


Fig. 4-12

2. Disconnect the connectors on the printed circuit board.

4-2-7 Tuner assembly

1. Remove two screws on the tuner assembly as shown in Fig. 4-13.
2. Disconnect the connectors on the printed circuit board.

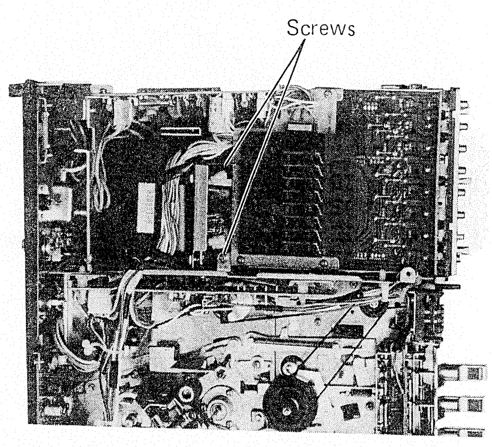


Fig. 4-13

SECTION 5
MECHANICAL ADJUSTMENTS

5-1 PRECAUTIONS

When repairing the HR-3300E, the following precautions should be observed:

1. Always turn the power off before removing or soldering components.
2. When removing a screw from the chassis, be careful not to drop it into the mechanism. If a screw should be dropped, be sure to retrieve it.
3. Be extremely careful not to damage either the upper or lower head drum assemblies.
4. The tape transport mechanism has been precisely adjusted at the factory and ordinarily need not be re-adjusted.
5. When removing a part, be very careful not to damage or displace other parts. (Be especially careful with the guide poles and rotary video head drum.)
6. To check the mechanism without a tape, lock the cassette microswitch (S12). Also cover the photo transistor sensor so that the no light falls on it.

NOTE: After the check and repair are completed, do not forget to remove the covering.

5-2 PERIODIC MAINTENANCE

The following components need periodic cleaning and lubrication to maintain normal efficiency.

5-2-1 Cleaning

A. Drum system

1. Clean the upper and lower drums, the full erase head, the two guide poles and two guide rollers occasionally. Since these parts make direct contact with the video tape they tend to collect dust.
   CAUTION: When cleaning the two video heads on the upper drum, DO NOT clean them with a vertical stroke. Use only a gentle back and forth motion, in the direction of the tape path, being very careful since they are made of ferrite and may be broken easily.
2. For cleaning, use a lint-free cloth dampended with pure isopropyl alcohol.
3. The drum system should be cleaned after every 200—300 hours of use.
4. After cleaning with alcohol, allow the parts to dry before using a cassette tape since alcohol on these parts may impair the tape.

B. Pinch roller and capstan shaft

1. Dust on the pinch roller or the capstan shaft can impair their operation.
2. Clean the pinch roller surface and the capstan shaft with a mild detergent solution and a lint-free cloth.
   NOTE: Alcohol can deteriorate rubber.

C. Reel drive system

The following components need periodic cleaning. (Refer to Fig. 5-1(a).)

1.	Surface of the supply reel disk	㉗
2.	Surface of the rewind idler	㉓
3.	Surface of the F.F. pulley	㉑
4.	Surface of the unloading idler	㉕

D. Motor drive system

Drum pulley, Drum belt, Drum motor pulley, Capstan motor pulley, Relay belt, Relay pulley, Capstan pulley, Capstan flywheel, Reel drive belt, Unloading belt, Take-up pulley, Rewind pulley, Unloading pulley.

5-2-2 Lubrication

The following points should be lubricated with JVC oil (Part No. PU41761) or other high quality spindle oil every 500 hours.

Shaft of counter idler pulley,
Shaft of take-up and supply reel disk.

CAUTION: DO NOT overlubricate. Two or three drops of oil in each location is sufficient.

5-3 LAYOUT OF MAIN MECHANICAL PARTS

A. Top view and parts identification

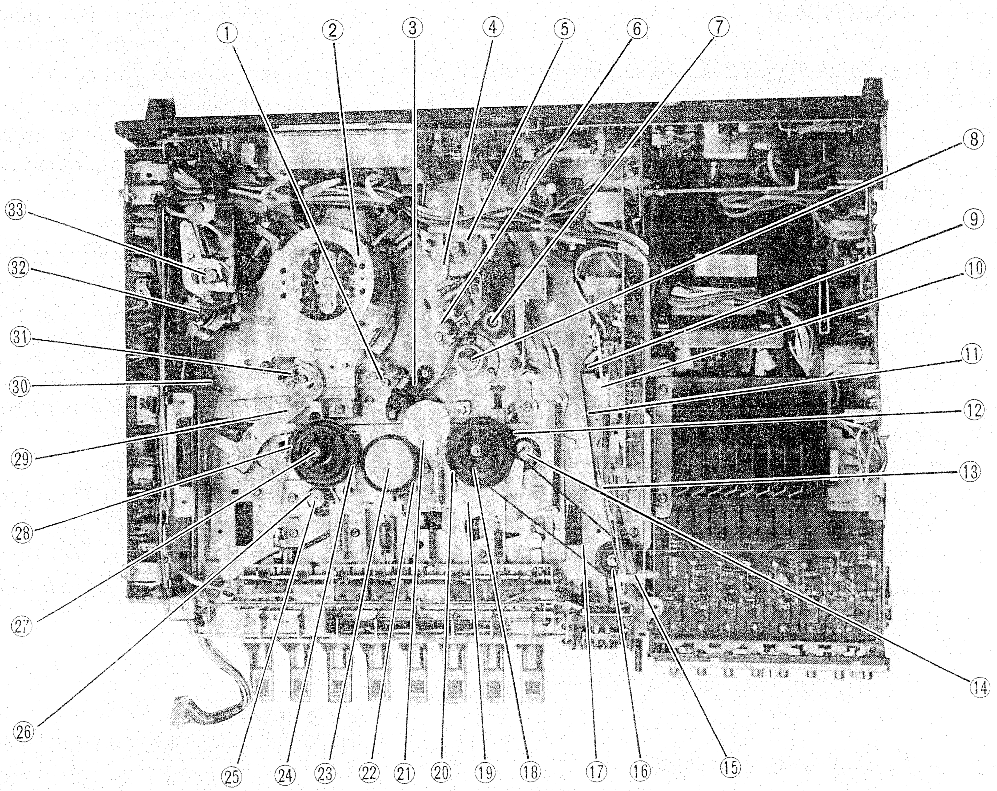


Fig. 5-1 (a) Top view

1. Take-up loading arm
2. Upper drum (Video heads)
3. Cassette lamp
4. Audio erase head
5. Take-up impedance roller
6. Audio/control head
7. Pinch roller
8. Capstan shaft
9. Start sensor
10. Relay pulley
11. Relay belt
12. Take-up reel disk rubber tire
13. Capstan motor pulley
14. Take-up idler
15. Counter belt-2
16. Counter pulley
17. Counter pulley-1
18. Take-up reel disk
19. Take-up brake
20. Loading brake
21. F.F. idler
22. REW rubber tire
23. REW idler
24. Tension band
25. Unloading idler
26. Unloading idler rubber tire
27. Supply reel disk
28. Loading tension brake
29. Tension arm
30. End sensor
31. Supply loading arm
32. Full erase head
33. Supply impedance roller

B. Bottom view and parts identification

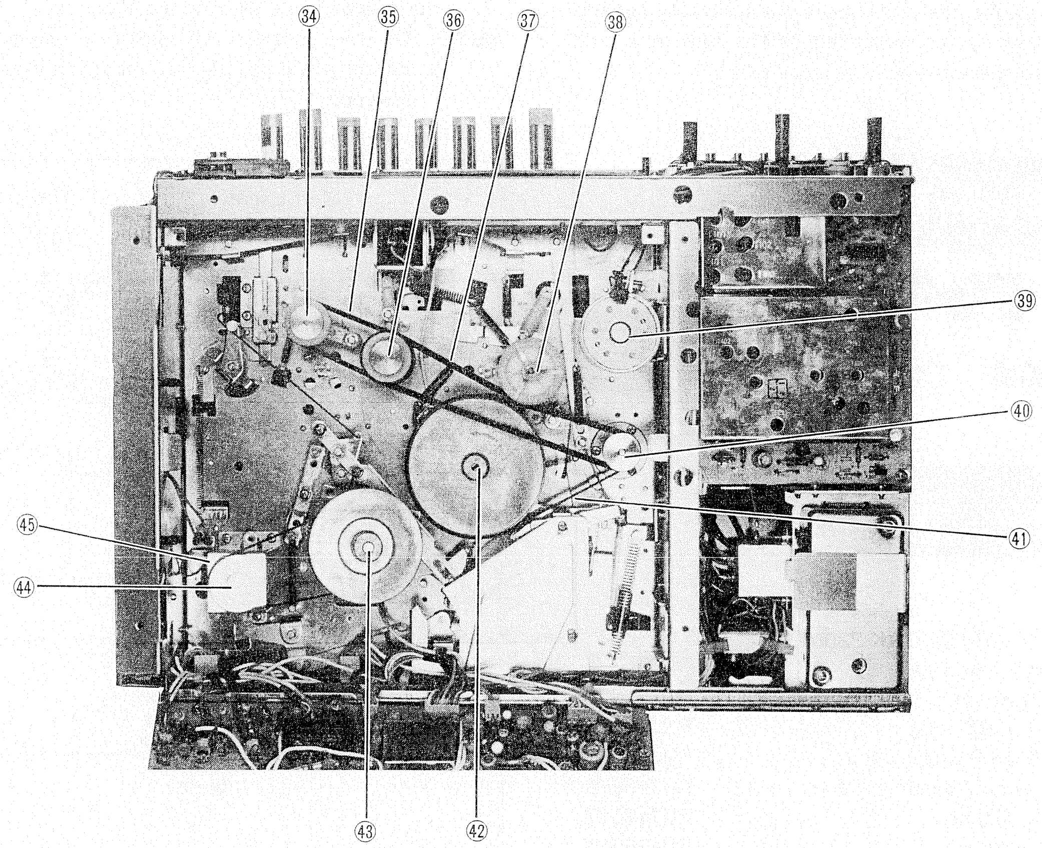


Fig. 5-1(b) Bottom view

34. Unloading pulley
35. Unloading belt
36. Rewind pulley
37. Reel drive belt
38. Take-up idler
39. Capstan motor
40. Relay pulley
41. Capstan belt
42. Capstan flywheel
43. Drum pulley
44. Drum motor pulley
45. Drum motor

5-4 REPLACEMENT AND ADJUSTMENT

5-4-1 Jigs and tools

For proper mechanical adjustment, the following jigs and tools are strongly recommended. Without them, a long trial-and-error period would be necessary.

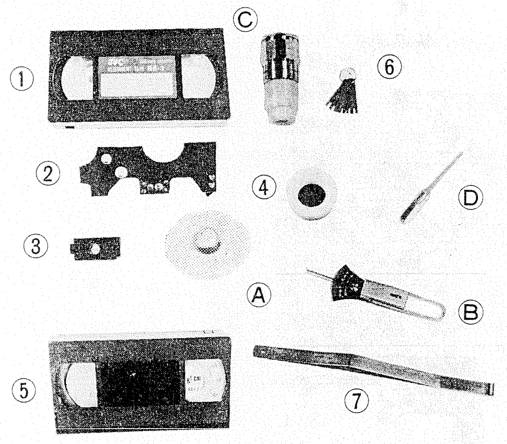


Fig. 5-2 Jigs

ALIGNMENT KIT (RAK-3300)

① JVC Alignment Tape	MH-2
② Master Plane Jig	PUJ35730
③ Reel Disk Height Jig	PUJ48014
④ Master Plane Position Jig	PUJ48015
⑤ Back Tension Adjustment Jig	PUJ48076
⑥ Thickness Gauge	PUJ48017
⑦ Cassette Holder	PUJ35731

OPTIONAL

Ⓐ Tension Check Dummy Reel	PUJ48073
Ⓑ Tension Gauge	PUJ48074
Ⓒ Torque Gauge* (600 gcm torque meter and VHS adapter)	PUJ48075
Ⓓ JVC Oil	PU41761

In addition, general-purpose tools and metric hex keys (not supplied by JVC) are required for the following alignment procedures.

5-4-2 How to set the master plane jig

1. Set machine to stop mode.
2. Remove the cassette housing.
3. Set the master plane jig on the base of the drum assembly as shown in Fig. 5-3(a), then fasten the screw which is provided with the master plane jig.
   NOTE: This is a special metric-thread screw. DO NOT use non-metric thread screw.
4. In the case of the tension pole positioning check, first set the cassette housing positioning jig to the supply reel disk as shown in Fig. 5-3(b), then set the master plane jig with a screw.

NOTE: On the occasion of setting or removing the master plane jig, pay full attention to the drum assembly.

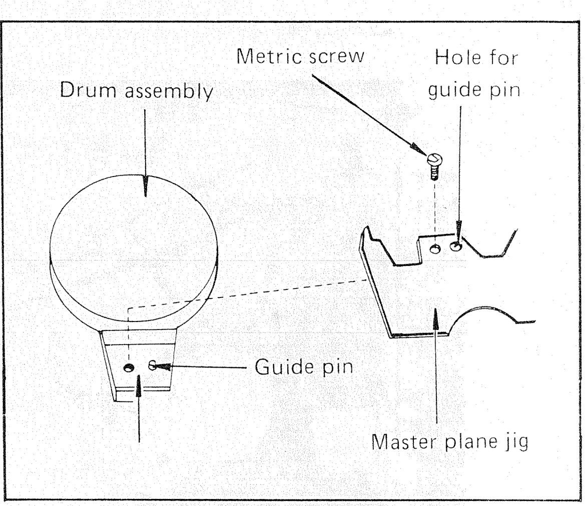

Metric screw
Hole for guide pin
Drum assembly
Guide pin
Master plane jig

Fig. 5-3(a)

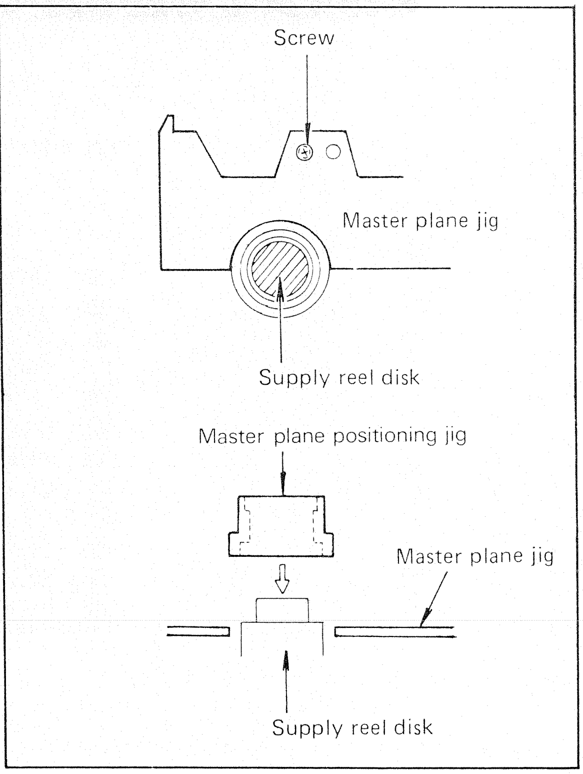

Screw
Master plane jig
Supply reel disk
Master plane positioning jig
Master plane jig
Supply reel disk

Fig. 5-3(b)

---

* If you already own a VCR torque gauge (PUJ40049) previously supplied – Torque Gauge VHS Adapter (PUJ48016) by JVC.

5-4-3 Replacement of belts

The following belts should be checked for signs of wear every 1,000 hours. Replace if necessary.
Refer to Fig. 5-1 (a) and (b) for location.

Part No.	Part Name	Symbol No.
PU44912	Relay belt	⑪
PU44863-2	Counter belt-2	⑮
PU44863	Counter belt-2	⑰
PU44912-3	Unloading belt	㉟
PU44911	Reel drive belt	㊲
PU44912-2	Capstan belt	㊶
PU44912-5	Drum belt	㊻

5-4-4 Replacement of cassette housing assembly

If the tape transport operates without the cassette being correctly positioned, the tape may be damaged and become unusable. Thus, the cassette housing plays a very important role although its function is rather simple. It is improbable that the cassette housing will become faulty. However, it is occasionally necessary to remove the internal mechanism, and if the housing is not replaced correctly the result will be the same as if the housing were defective.

Removal:

1. Remove four screws Ⓐ from both sides of the cassette housing assembly as shown in Fig. 5-4.
2. Draw out the cassette housing by lifting it straight up.

   NOTE: When operates the unit without the cassette housing, press the cassette switch (S12) by hand. Also, light from the lamp should be excluded by covering the phototransistor sensor.

Replacement:

1. Place the new cassette housing assembly to the unit. In this time, set the lock lever on the cassette housing assembly between the eject plate and the function assembly as shown in Fig. 5-4. If the lock lever is not in correct position, the eject key will not operate. And also, check that the spring plate touches to the function assembly.
2. The top portion of the two reel disks (Take-up and Supply) should project into the housing when press the cassette housing by hand.
3. Tighten the four screws Ⓐ . Ⓑ . Then push the eject key downward, and remove the jig from the cassette housing.
4. Insert the spare cassette slowly into the cassette housing, and check that the cassette is loaded correctly.
5. Set the equipment to the play mode, and check that the tape edge is not folded or wrinkled as it exits and enters the cassette.

   NOTE: When the cassette housing assembly is faulty, the entire assembly will be replaced with a new one. The assembly is factory-adjusted, and its disassembly is not recommended.

5-4-5 Replacement of reel disk

Removal:

1. Remove the cassette housing as referring to subsection 5-4-4 "Replacement of the cassette housing" Removal.

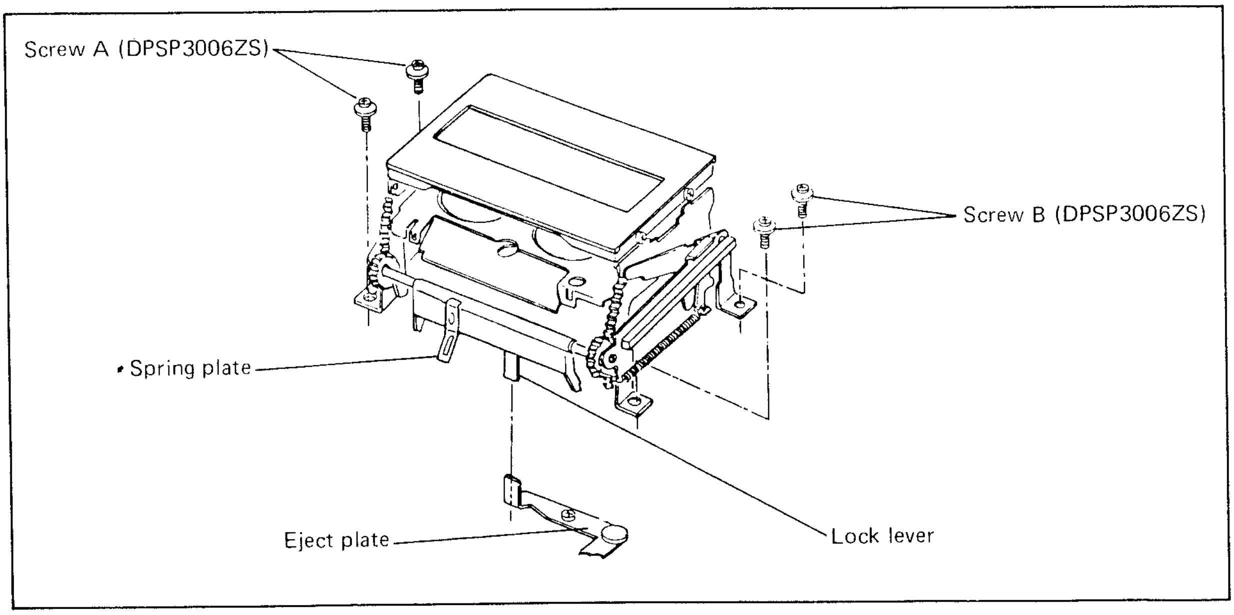


Fig. 5-4 Replacement of cassette housing

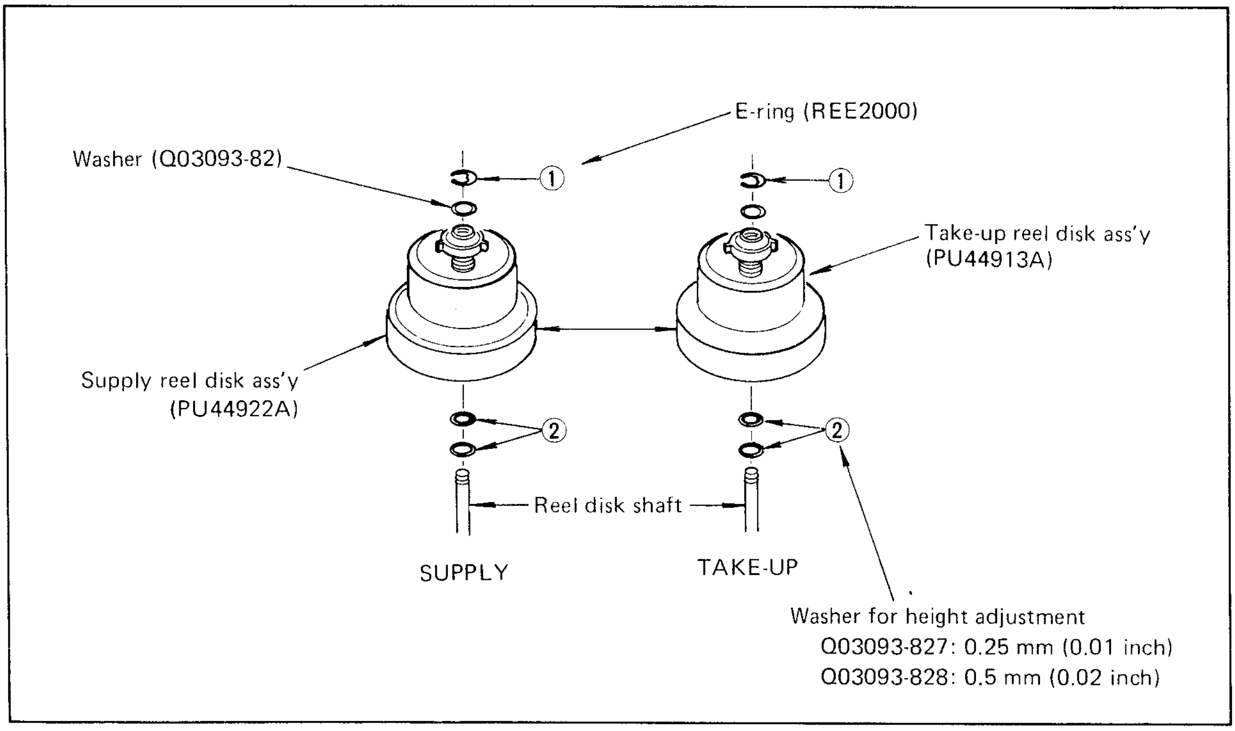

E-ring (REE2000)
Washer (Q03093-82)
①
①
Take-up reel disk ass'y
(PU44913A)
Supply reel disk ass'y
(PU44922A)
②
②
Reel disk shaft
SUPPLY
TAKE-UP
Washer for height adjustment
Q03093-827: 0.25 mm (0.01 inch)
Q03093-828: 0.5 mm (0.02 inch)

Fig. 5-5 Replacement of reel disk

2. Remove the E-ring ①located in the top portion of the reel disk as shown in Fig. 5-5.
3. Remove the E-ring on the top of the supply tension arm shaft, then remove the tension band.
   NOTE: When taking off the brake band, be careful of the brake band to avoid bending it. If deformed, the brake band will have to be replaced with a new one.
4. Then take off the reel disk upward.
   NOTE: The metal washers ② at the bottom of the reel disk are apt to come off with the reel disk. Be careful not to lose the metal washers ②.
5. When the new reel disk is set in place, following adjustment is necessary.

Height adjustment:

1. Set the master plane jig as referring to subsection 5-4-2 "How to set the master plane jig".
2. After the master plane jig is set in place, check the reel disk height by using the height adjustment jig.
3. Place the height adjustment jig on the master plane jig, check the reel disk height to be lower than "A" area and higher than "B" area as shown in Fig. 5-6.
4. To adjust the height, add or remove a 0.25 mm washer (Q03093-827) or 0.5 mm washer (Q03093-828).
5. After the height adjustment, lubricate the reel disk shaft. When the supply reel disk is replaced, check the back tension as referring to subsection 5-4-12 "Back tension adjustment".

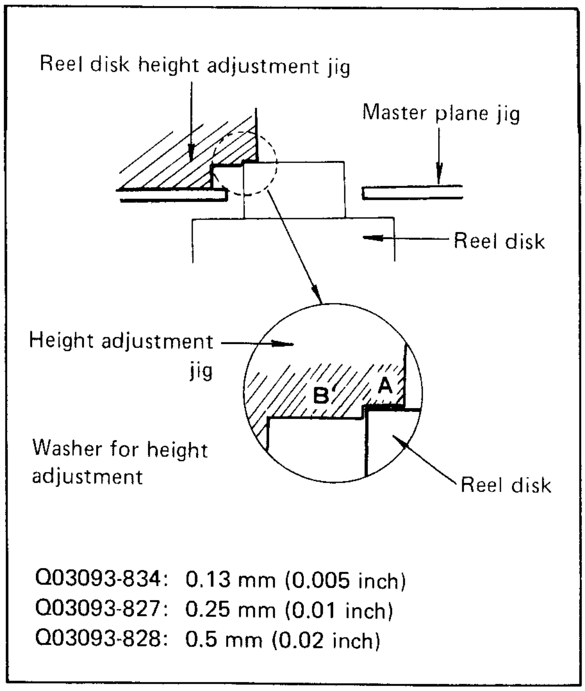

Reel disk height adjustment jig
Master plane jig
Reel disk
Height adjustment jig
B
A
Washer for height adjustment
Reel disk
Q03093-834: 0.13 mm (0.005 inch)
Q03093-827: 0.25 mm (0.01 inch)
Q03093-828: 0.5 mm (0.02 inch)

Fig. 5-6 Reel disk height adjustment

5-4-6 Adjustment of the supply loading back tension

1. Remove the cassette housing assembly.
2. Set the unit to play mode without cassette installed.
3. Turn off the power before loading arm reached to the loading end while pushing the PLAY key by hand, so that the PLAY key locked by the function mechanism after turn off the power.
4. Set the tension check reel on the supply reel disk.
5. Measure the supply loading tension by pulling the video tape, and reading a tension gauge as shown in Fig. 5-7.
   The measured loading tension should be between 40 and 50 grams.

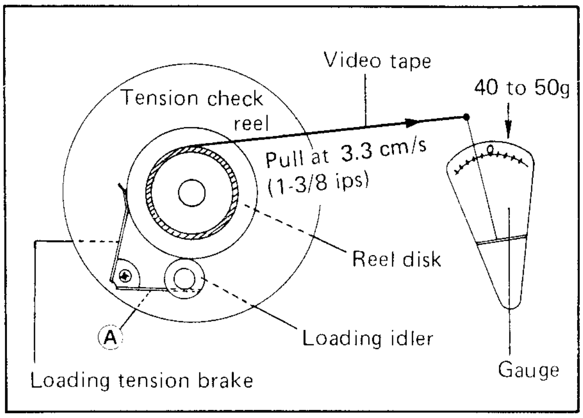


Fig. 5-7

6. If not, following adjustment is necessary.
7. If the measured supply loading back tension is greater than 50 grams, bend the supply loading idler lever at point Ⓐ little by little as shown in Fig. 5-8(a).
8. If the measured supply loading tension is less than 40 grams, bend the supply loading lever at point Ⓐ little by little as shown in Fig. 5-8(b).

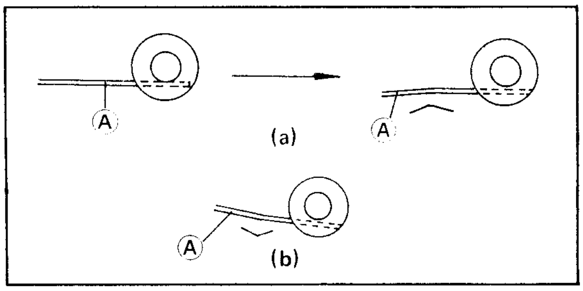


Fig. 5-8

9. After adjustment, measure the supply loading tension again
   Then, check that the correct tape transport is obtained in loading and unloading, and also that tape travels smoothly with no evident wrinkles during loading and unloading.

5-4-7 Adjustment of take-up loading brake

1. Remove the cassette housing assembly.
2. Set the unit to play mode without cassette housing installed.
3. Turn off the power before loading arm reached to the loading end while pushing the PLAY key by hand, and PLAY key locked by the function mechanism after turn off the power.
4. Set the tension check reel on the take-up reel disk.
5. Measure the take-up loading tension by pulling the video tape, and reading a tension gauge as shown in Fig. 5-9. The measured loading tension should be between 30 and 40 grams.

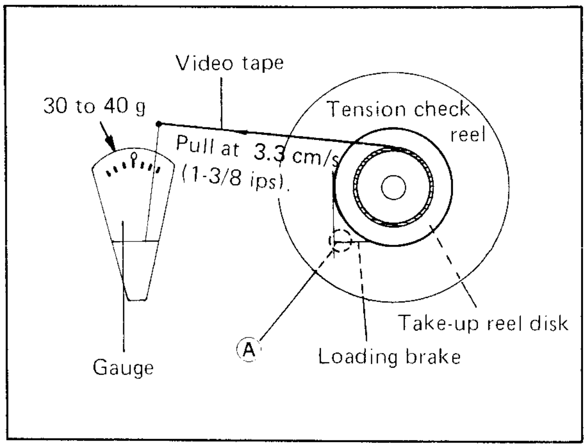


Fig. 5-9 Measurement of take-up loading tension

6. If not following adjustment is necessary.
7. If measured take-up loading tension is greater than 40 grams, bend the take-up loading brake lever at point Ⓐ little by little as shown in Fig. 5-10(a).

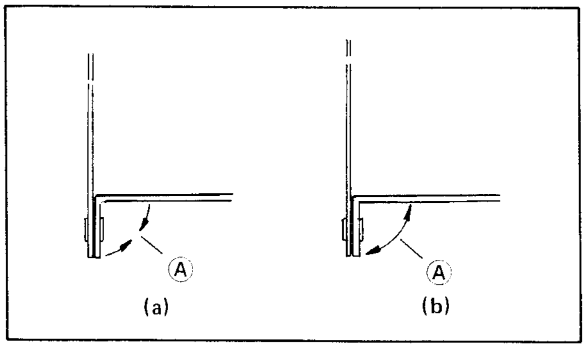


Fig. 5-10

8. If measured take-up loading tension is less than 30 grams, bend the take-up loading brake lever at point Ⓐ little by little as shown in Fig. 5-10(b).

9. After adjustment, measure the take-up loading tension again, also check that the correct tape transport is obtained in loading and unloading.

5-4-8 Adjustment of rewind torque

1. Remove the cassette housing assembly.
2. Set the unit to rewind mode without cassette tape. In this time, push the cassette switch (S12) and the play switch (S2) by hand, if not unit will go to stop mode.
   Before measurement, clean the following drive system as referring to subsection 5-2-1 "Cleaning".
   - Reel drive belt
   - Rewind pulley
   - Rewind idler
   - Supply reel disk.
3. Check the rewind torque by attaching the torque meter to supply reel disk.
4. Gradually loosen the gripped torque meter in your hand, and read the meter while the torque meter is slowly-slipping in your hand.
5. A proper rewind torque is more than 270 grams. If not, rewind idler replacement is necessary.

5-4-9 Adjustment of F.F. (fast forward) torque

1. Remove the cassette housing assembly.
2. Set the unit to F.F. mode without cassette tape.
3. Check the rewind torque by attaching the torque meter to take-up reel disk.
4. Gradually loosen the gripped torque meter in your hand, and read the meter while the torque meter is slowly-slipping in your hand.
   A proper F.F. torque is more than 270 grams.
5. If the F.F. torque is less than 270 grams, clean the following drive system.
   - Rubber tire of rewind idler
   - Rubber tire of take-up reel disk
   - F.F. pulley.

5-4-10 Adjustment of take-up torque

1. Remove the cassette housing assembly.
2. Set the unit to play mode without cassette tape. Push the cassette switch (S12) and the pause switch (S5) by hand, if not the unit will go to stop mode.
3. Before measurement, keep the unit to play mode about two minutes, then set the torque meter to the take-up reel disk.
4. Gradually loosen the gripped torque meter in your hand, and read the meter while the torque meter is slowly-slipping in your hand.
   A proper take-up torque is between 80–220 grams. If not following adjustment is necessary.

Adjustment-1

Before adjustment, clean the following drive system as referring to subsection 5-2-1 "Cleaning".

- Reel drive belt
- Take-up idler
- Take-up reel disk.

1. If the take-up torque is less than proper torque, adjust the position of spring of the take-up pulley assembly to direction of arrow (a) as shown in Fig. 5-11, then measure the take-up torque again.
2. If the take-up torque is greater than proper torque, set the spring of take-up pulley assembly to arrow (b) as shown in Fig. 5-11, then measure the take-up torque again.
   NOTE: When adjust the spring of take-up pulley assembly, always turn the spring to direction of arrow (c).

Adjustment-2

In the case the torque is still out of order as a result of adjustment-1, following adjustment is necessary.

1. Set the spring to center (D) of steps as shown in Fig. 5-11.
2. If the take-up torque is excessive less than proper torque, add the adjustment washer as shown in Fig. 5-12, then measure the take-up torque again.
3. If the take-up torque is excessive greater than proper torque, check the wear of rubber tire of take-up reel disk.
   NOTE: When assemble the friction disk assembly to shaft of the take-up idler, set 1.0 t thickness gauge between the take-up idler assembly and washer, then fasten the set-screw as shown in Fig. 5-12.

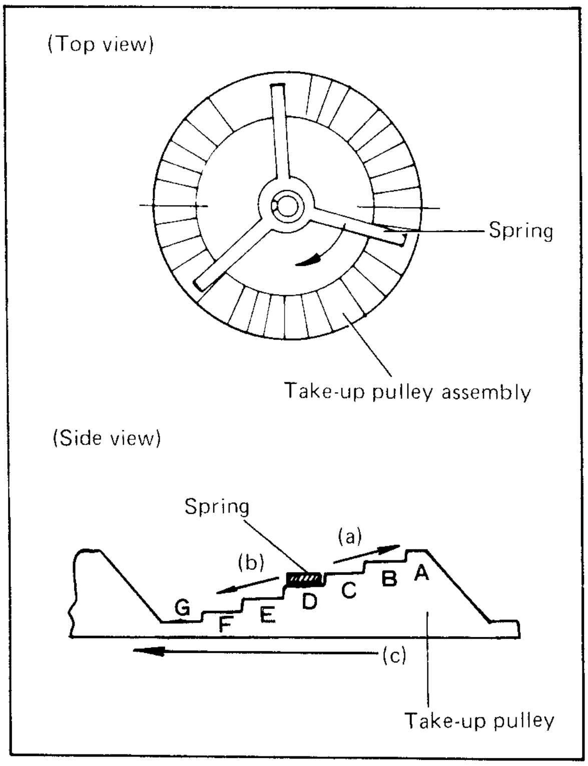


Fig. 5-11 Take-up pulley assembly

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* 0.3 mm thick

5-4-11 Adjustment of unloading torque

1. Remove the cassette housing assembly.
2. Before measurement, clean the following drive system as referring to subsection 5-2-1 "Cleaning".
   - Reel drive belt
   - Rewind pulley
   - Unloading pulley
   - Rubber tire of unloading idler
   - Supply reel disk
3. Set the torque meter to the supply reel disk, and push the play switch (S2) and the operation switch (S3), then gradually loosen the gripped torque meter in your hand, and read the meter while torque meter is slowly slipping in your hand.
4. A proper torque is between 80 and 220 grams.
5. If not, following adjustment is necessary.
6. If the unloading torque is much less than 80 grams, check the wear of reel drive belt and rubber tire of unloading idler.
7. If the unloading torque is excessive greater than 220 grams, replace the unloading idler.

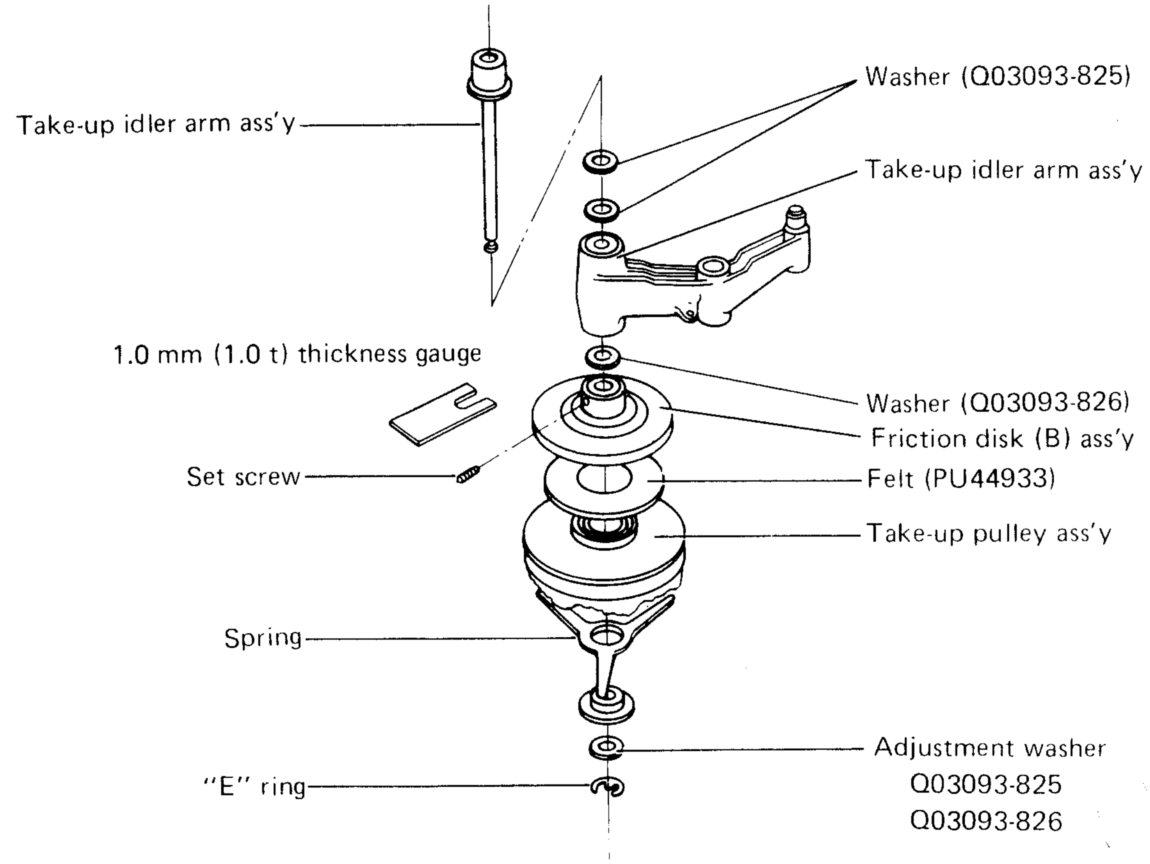

Take-up idler arm ass'y
Washer (Q03093-825)
Take-up idler arm ass'y
1.0 mm (1.0 t) thickness gauge
Washer (Q03093-826)
Friction disk (B) ass'y
Set screw
Felt (PU44933)
Take-up pulley ass'y
Spring
Adjustment washer
Q03093-825
Q03093-826
"E" ring

Fig. 5-12 Adjustment of take-up torque

5-4-12 Back tension adjustment

A: Adjustment of tension pole position

1. Remove the cassette housing assembly, then set the master plane jig as referring to subsection 5-4-2 "How to set the master plane jig".
2. Set the unit to play mode with E-180cassette tape (tape end condition).
3. After tape starts traveling, check the tension pole position as shown in Fig. 5-13. Clearance between tension pole and tip of master plane jig is 1.5 mm (0.06 inches).
4. If not, adjust the position of plate ④ by using screw ③ as shown in Fig. 5-13.

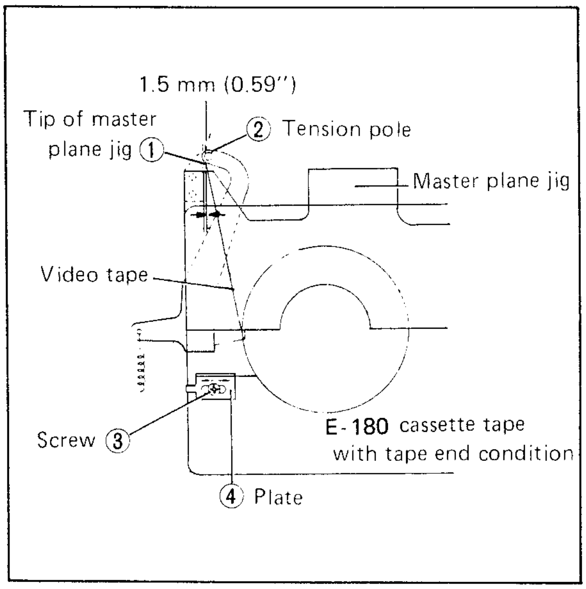

1.5 mm (0.59")
Tip of master plane jig ①
② Tension pole
Master plane jig
Video tape
Screw ③
E-180 cassette tape with tape end condition
④ Plate

Fig. 5-13 Back tension adjustment

B: Back-tension adjustment

1. Set the back-tension adjustment jig to the unit and set to play mode.
2. Read the meter in adjustment jig while meter is slowly-rotating in the cassette. A proper back tension is 28 to 45 grams.
3. If not following adjustment is necessary.
4. If measured back-tension is greater than 45 grams or less than 28 grams, adjust position of adjust plate ② by loosening screw ①, so that the back-tension should be 35 grams, then fasten screw ① as shown in Fig. 5-14.
5. After adjustment, set the unit to play mode with E-180 cassette tape, check the position of tension pole. In this time, the tension pole is not touching the cassette.
6. Recording and then play back the picture, check the switching point which is 3.5 horizontal lines before the V-blanking signal, so that there is no skew problem at the switching point.

5-4-13 Replacement of capstan motor

1. Remove the four screws and belt guard from the chassis as shown in Fig. 5-15.
2. Remove the capstan motor pulley by using metric hex key.
3. When mounting a motor pulley to a DC motor, be careful to install on a motor shaft exactly as shown in Fig. 5-16. Set 1.5 mm thickness gauge between motor and motor pulley, then fasten the setscrew.
4. After replacement, verify the belt running position. Also servo circuit adjustment subsection 6-3, "Adjustment of capstan servo".

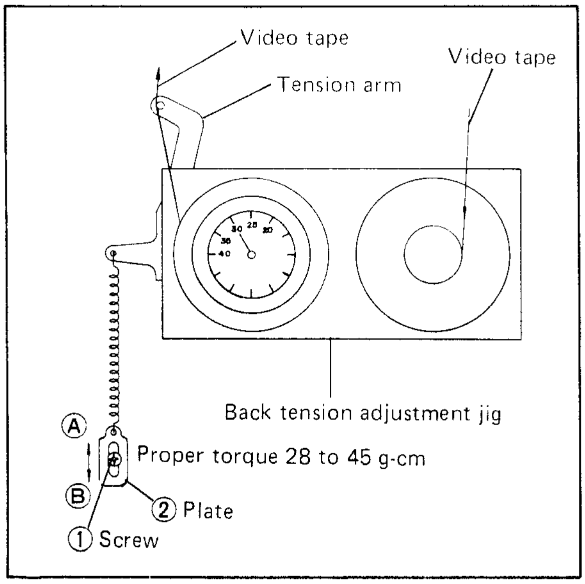

Video tape
Video tape
Tension arm
Back tension adjustment jig
Ⓐ
Ⓑ
Proper torque 28 to 45 g-cm
② Plate
① Screw

Fig. 5-14 Back tension adjustment

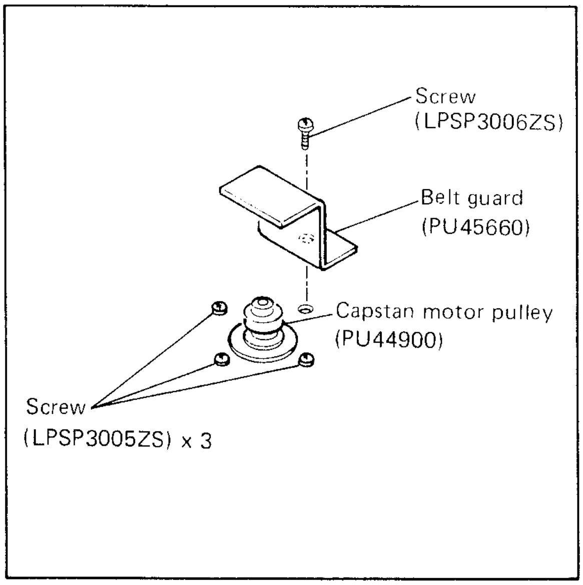

Screw
(LPSP3006ZS)
Belt guard
(PU45660)
Capstan motor pulley
(PU44900)
Screw
(LPSP3005ZS) x 3

Fig. 5-15 Capstan motor replacement

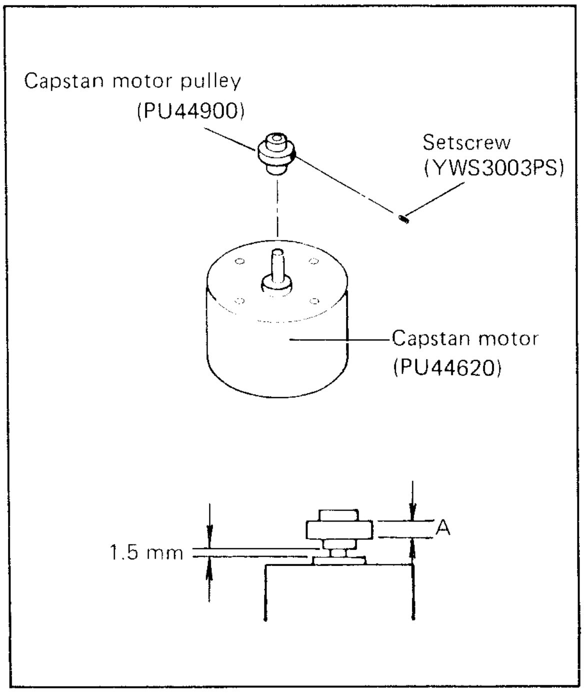

Capstan motor pulley
(PU44900)
Setscrew
(YWS3003PS)
Capstan motor
(PU44620)
1.5 mm
A

Fig. 5-16

5-4-14 Replacement of drum motor

1. Remove the drum belt, and remove three screws as shown in Fig. 5-17.
2. Remove drum motor pulley by metric hex key and, then remove the drum DC motor by loosening three screws.
3. When mounting a motor pulley to a DC motor, set 0.7 mm thickness gauge between drum motor and motor pulley as shown in Fig. 5-18.

   After replacement, verify the belt running position in play mode. Also adjustment of drum servo circuit is necessary. (Refer to subsection 6-3.)

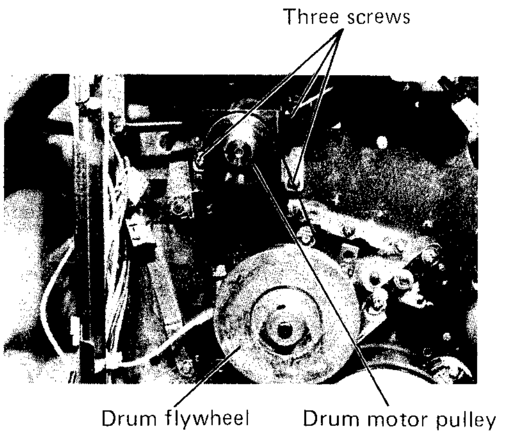

Three screws
Drum flywheel
Drum motor pulley

Fig. 5-17 Replacement of drum motor

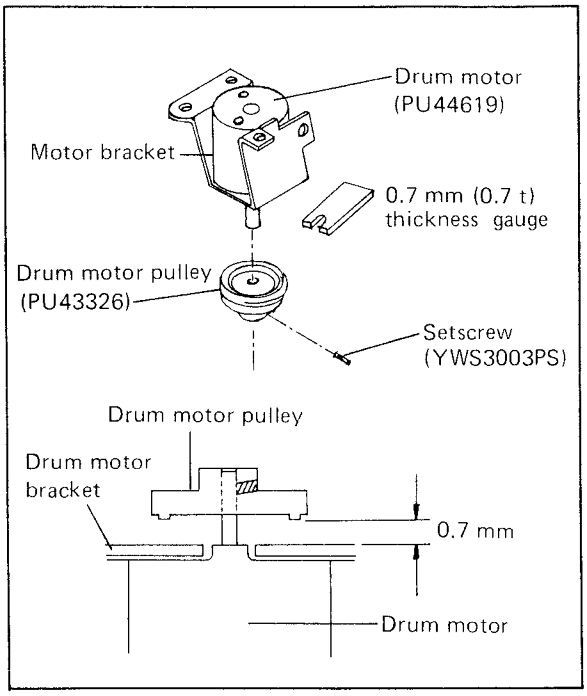

Drum motor
(PU44619)
Motor bracket
0.7 mm (0.7 t)
thickness gauge
Drum motor pulley
(PU43326)
Setscrew
(YWS3003PS)
Drum motor pulley
Drum motor
bracket
0.7 mm
Drum motor

Fig. 5-18

5-4-15 Replacement of audio/control head assembly

A: Replacement

1. Remove three screwsⒶ,Ⓑ,Ⓒas shown in Fig.5-19.
2. Unsolder the mini printed board located behind the audio/control head.
3. Solder the mini printed board to the new head assembly.

   NOTE: Do not damage the head surface.
4. Install the new head assembly in the correct position by using three screwsⒶ,Ⓑ,Ⓒ as shown in Fig. 5-19.

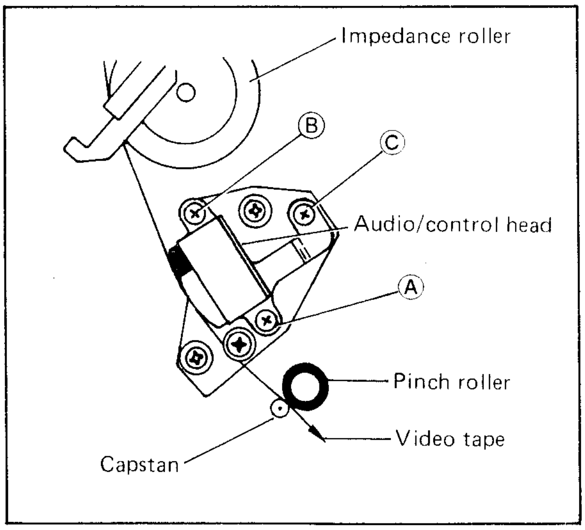

Impedance roller
Ⓑ
Ⓒ
Audio/control head
Ⓐ
Pinch roller
Video tape
Capstan

Fig. 5-19

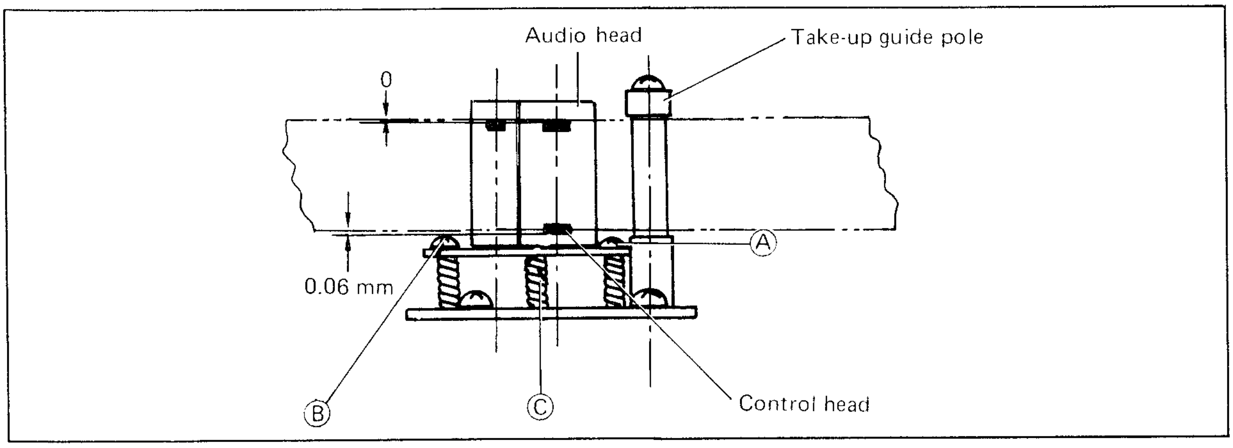


Fig. 5-20

B: Adjustment

1. Before adjustment, check the tape travel between guide roller — take-up impedance roller — guide pole — capstan shaft with a spare cassette tape, so that the tape should be travel smoothly with no wrinkles.
2. If an unsatisfactory condition is found by the above check, adjust the three screws Ⓐ, Ⓑ, Ⓒ by turning in small increments.
   The normalized tape travel is shown in Fig. 5-20.
3. Connect the oscilloscope to TP-15 on the audio amplifier of Audio and Servo printed circuit board.
4. After normal tape traveling is obtained, playback the JVC alignment tape to reproduce the audio 7 kHz signal.
   NOTE: Do not use the JVC alignment tape, before smooth tape traveling is assured. Otherwise, it may be damaged.
5. Adjust the screw Ⓐ, Ⓑ, Ⓒ for the playback signal at TP-15 to be maximum.
6. After adjustment, verify the head height as shown in Fig. 5-20. And also, check for smooth tape traveling.
7. When replace the audio/control head following electrical adjustment is necessary.
   •Subsection 6-6 'Adjustment of audio circuit".
8. The preceding steps provide for complete adjustment of the audio/control head assembly. Finally, by recording and then playing back the video, confirm that the playback picture is normal. Again, as a final check, playback to reproduce the monoscope segment from the JVC alignment tape. Also check the FM output level at TP-6 on Pre-Rec amplifier printed circuit board to be maximum at Tracking potentiometer "Auto" position.

5-4-16 Replacement of video head assembly

1. Unsolder the wire ①, then unsolder the brown wire ② and red wire ③.
2. Remove the two screws ④, then pull-up the upper drum assembly.
3. Install the new head assembly and solder the wires as shown in Fig. 5-21.
4. Fasten two screws ④.
5. After replacement, following adjustment is necessary.
   1) Playback switching point adjustment (subsection 6-3-9.
   2) Recording switching point adjustment (subsection 6-3-10).
   3) Tracking adjustment (subsection 6-3-11).
   4) Video head Q (Quality factor) and resonance adjustment (subsection 6-4-1).
   5) Playback FM channel balance (subsection 6-4-2).
   6) Playback color channel balance and color level (subsection 6-5-5, 6-5-6).
   7) Recording color channel balance and color level (subsection 6-5-9).
   8) Checking of D.O.C. (Dropout compensator) level (subsection 6-4-10).

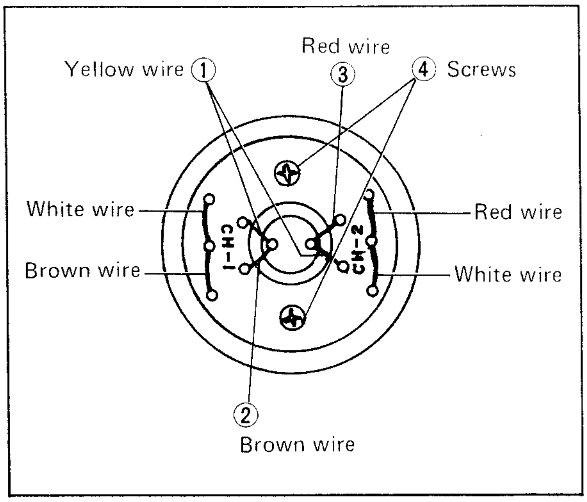


Fig. 5-21 Replacement of video head assembly

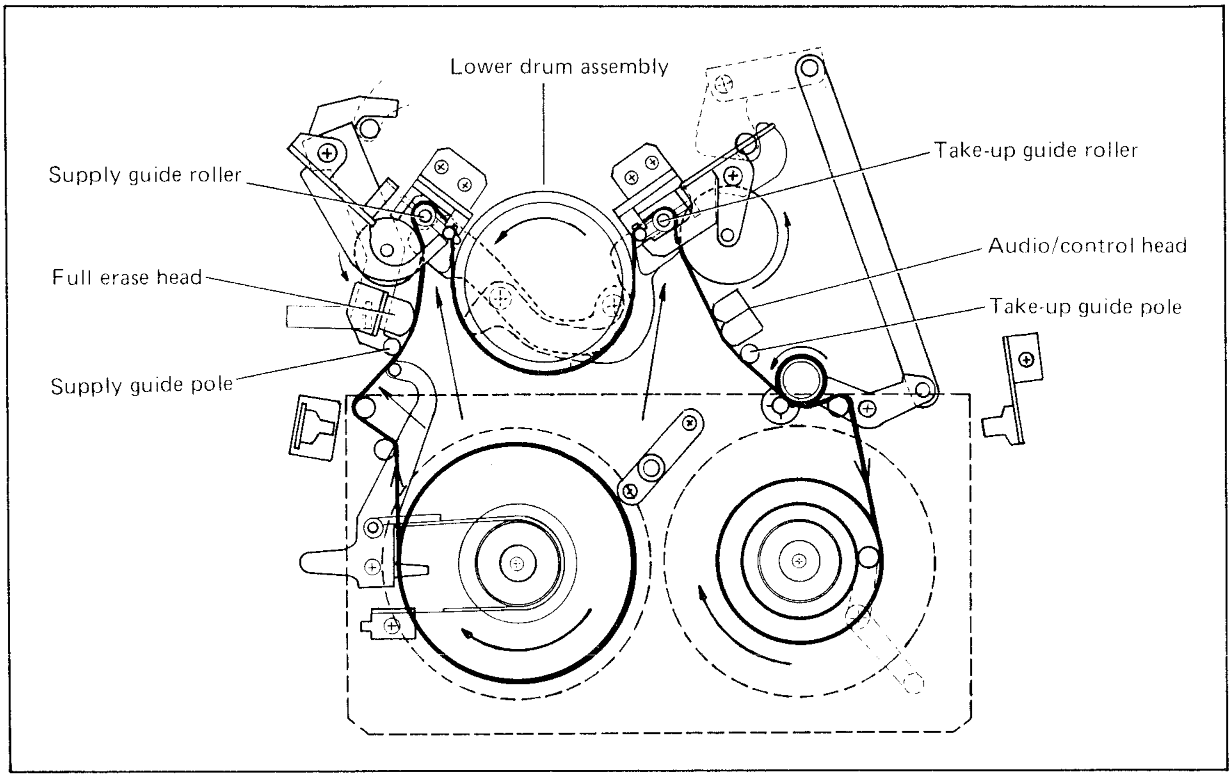

Lower drum assembly
Supply guide roller
Full erase head
Supply guide pole
Take-up guide roller
Audio/control head
Take-up guide pole

Fig. 5-22 Tape path

5-4-17 Tape transport system checking

It is very important for this video cassette recorder, that in the play mode the tape travels in a smooth, uncreased path from the tape outlet of the video cassette to tape inlet of the video cassette. This section is very carefully factory-adjusted. When a part associated with this section (such as the supply back-tension pole, audio/control head assembly, pinch roller assembly, etc.) has been replaced, the tape transport must be checked according to the procedure described in the applicable section. It is important that faulty tape travel subsequent to replacement of a part and those parts must be remedied by adjusting that part and those parts directly involved in the replacement. This makes it possible to obtain a tape path equal to original factory-adjusted. If this is neglected and other parts (guide pole, etc.) are adjusted, a good result (for tape transport adjustment) can never be obtained.

Do NOT touch the two guide poles and two guide rollers assembly.

For checking of tape path, observe the following steps.

A: Tension pole

1. Set the unit to play mode with cassette tape installed.
2. While tape traveling, check the tape path at the outlet of the cassette tape and the supply back tension pole, there is no tape wrinkles as shown in Fig. 5-23.
3. If not, check the tension pole parallelism.
4. Set the master plane jig as referring to subsection 5-4-2.
5. Set the unit to play mode without cassette tape installed.
6. Place the reel disk height adjustment jig on the master plane jig and adjust the tilt of the tension pole as shown in Fig. 5-24.
   After adjustment, check the tape path again.

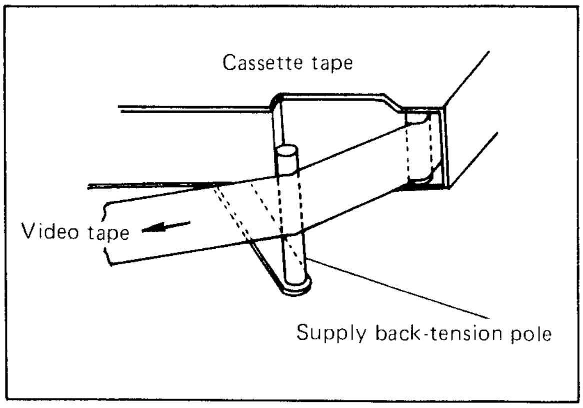

Cassette tape
Video tape
Supply back-tension pole

Fig. 5-23

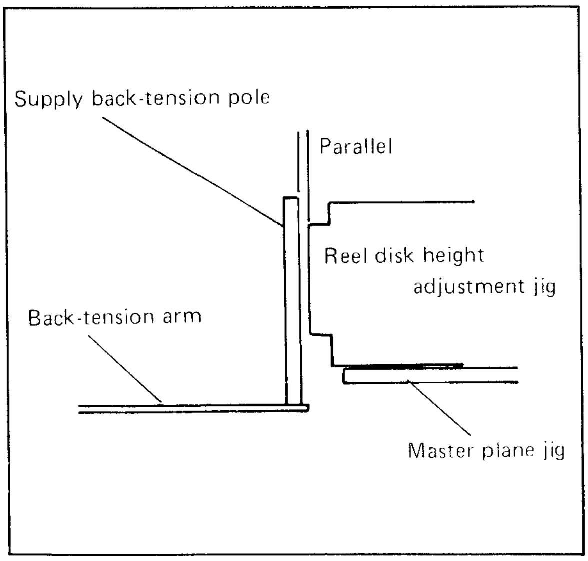

Supply back-tension pole
Parallel
Reel disk height adjustment jig
Back-tension arm
Master plane jig

Fig. 5-24

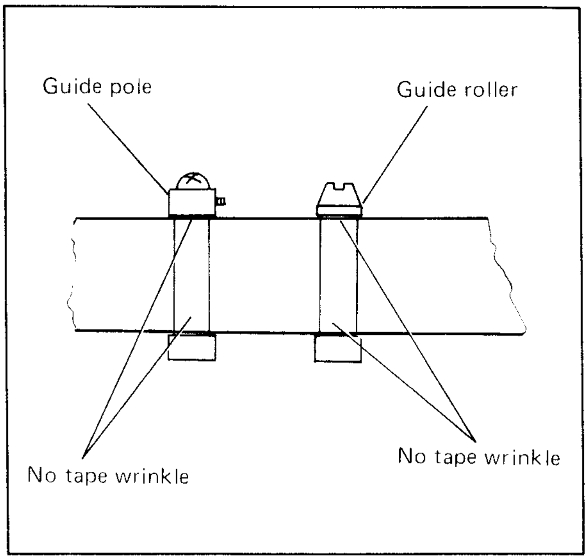

Guide pole
Guide roller
No tape wrinkle
No tape wrinkle

Fig. 5-25

B: Supply guide pole, Full erase head, Guide rollers, Take-up guide pole

1. Set the unit to play mode with cassette tape installed.
2. Verify the tape traveling at the supply guide pole, full erase head, guide rollers and take-up guide pole, so that there is no tape wrinkles as shown in Fig. 5-25.

5-4-18 Function key check

A: Function key

1. After press the PLAY key, other function keys will not operate except STOP and PAUSE keys.
2. After press the F.F. key, other function keys will not operate except STOP and PAUSE key.
3. After press the REW key, other function keys will not operate except STOP and PAUSE keys.
4. After pressing the PAUSE key, FULL REC (full record) and AF REC (after record) key will operate with.
5. When press the STOP key from the play mode, function key will not operate during unloading except STOP and PAUSE key.

B: Function microswitch

1. When press the PLAY, F.F. or REW key, microswitch (S1) and (S4) are both operates.
2. When press the PLAY key, microswitch (S2) is turned on.
3. When press the REW key, microswitch (S3) is turned on.
4. When press the PAUSE key, microswitch (S5) is turned on.

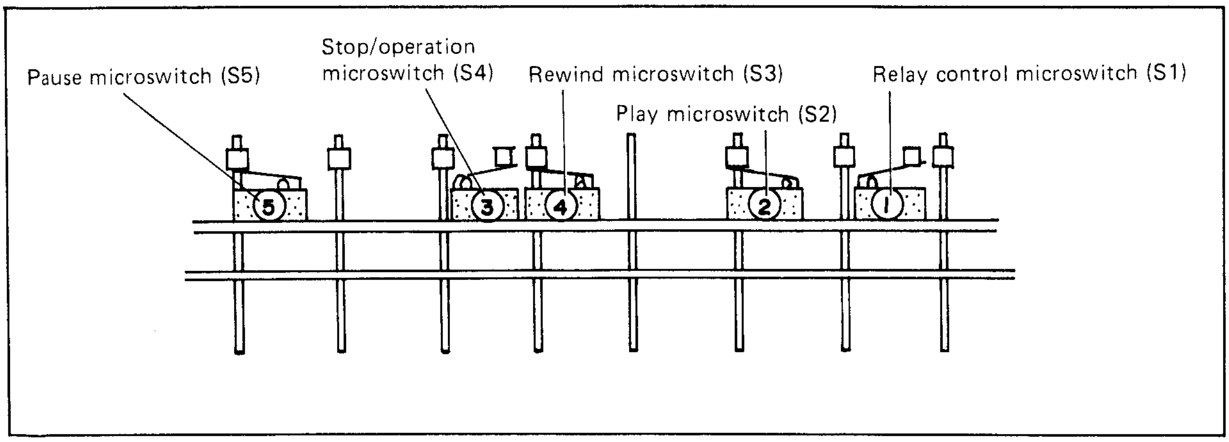

Pause microswitch (S5)
Stop/operation microswitch (S4)
Rewind microswitch (S3)
Relay control microswitch (S1)
Play microswitch (S2)
⑤
③
④
②
①

Fig. 5-26

SECTION 6
ELECTRONIC ADJUSTMENTS

6-1 GENERAL

6-1-1 Introduction

The JVC HR-3300E is designed for high reliability. The electrical system has been completely adjusted and carefully inspected before shipment from the factory. For this reason, the following procedure is needed principally when mechanical parts are replaced and re-adjustment of the electronic and signal systems is made necessary by such replacement.

If the electrical system should fail, be sure to check all voltages and waveforms before attempting any adjustments. Note that correct operation is achieved only when all circuits are properly adjusted, and therefore, improper adjustment of a single "block" of circuits may disrupt all functions. The best procedure is to locate the cause of trouble first, then begin repair, replacement or adjustment.

This section describes the electrical adjustments which may become necessary when printed circuit board or major components have been replaced.

An MOS type IC is employed in this HR-3300E. The MOS IC's are extremely fragile and may be very easily destroyed by improper handling. Always observe the following precautions when servicing this unit.

The MOS IC's are the following:

MSM-4011, MSM-4023, CD-4023, CD-4520B, CK-3300, 3SK49Q.

1. These ICs are shipped pinned to a conductive foam plastic base. They must not be separated from this base while in storage. If you are using one of several ICs pinned to a common base, remove it from the others by cutting the base. Keep the base attached to the IC until you are ready to mount it. Do NOT substitute any other material for the base.
2. There are several precautions to be observed when soldering the new IC into the circuit. Always use a low wattage soldering iron with an isolation transformer. The work bench should be covered with a conductive metal sheet with the chassis under repair grounded.
3. If it is impossible to obtain an isolation transformer, the soldering iron tip, chassis and technician must all be at a common potential.
4. When the IC is installed and power applied, the case is at +9 V DC. If the case is shorted to ground, the IC may be damaged.

Equipment required:

Oscilloscope : Wide-band, Dual-trace
Digital voltmeter : HEWLETT-PACKARD
Model 3476A/B or equivalent
Frequency counter : HEWLETT-PACKARD
Model 5381A or equivalent
Signal generator : Colour bar, Stairstep
Alignment tape : JVC MH-2

6-2 REGULATOR CIRCUIT

6-2-1 Adjustment of 12 V DC power supply

1. Connect a DC voltmeter to TP-1 (12 V OUT) on the Regulator circuit board as shown in Fig. 6-41.
2. Set the unit to record mode and adjust R11 (12 V ADJ.) so that the DC voltage of TP-1 is 12 ± 0.1 volts.
3. Then connect the oscilloscope to TP-1, verify the ripple of TP-1 is less than 5 millivolts peak-to-peak.

6-3 ADJUSTMENT OF SERVO CIRCUIT

– CAPSTAN SERVO CIRCUIT –

Refer to Fig. 6-44 Audio/Servo amplifier printed circuit board.

6-3-1 Capstan sampling waveform check

1. Set the unit to record or play mode.
2. Connect the oscilloscope to TP-11 (CAP. SAMPLING) on servo circuit of the Audio/Servo printed circuit board.
3. Check the position of the reference signal on the waveform as shown in Fig. 6-1.
4. If no reference signal appears on TP-11, connect the oscilloscope to TP-13 (475.2 Hz OCS OUT) and check the waveform on TP-13 as shown in Fig. 6-2.

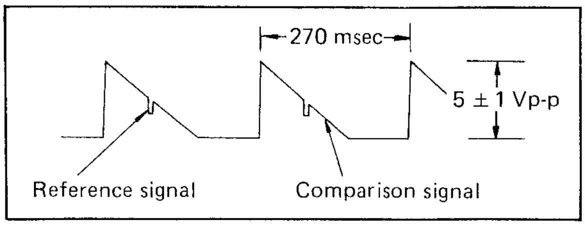


Fig. 6-1 Capstan sampling

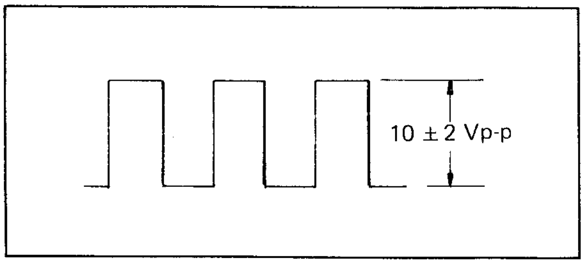


Fig. 6-2 Output of 472.5 Hz OSC.

5. If no comparison signal (sawtooth waveform) appears at TP-11, connect the oscilloscope to TP-10 and check the waveform as shown in Fig. 6-3.
6. If reference signal is not locked on the comparison signal at TP-11, the capstan servo circuit has improper adjustment or fail, so that re-adjustment or repair is needed.

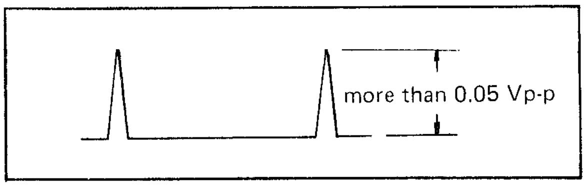


Fig. 6-3 Capstan pick-up pulse

6-3-2 Capstan sampling position adjustment

1. Set the unit to record mode or playback mode.
2. Connect the oscilloscope to TP-12 (CAP. PHASE ERROR) on servo circuit of Audio/Servo printed circuit board.
3. Adjust R74 (CAP. SAMPLING POSITION), so that the DC voltage of TP-12 is 7.5 volts DC as shown in Fig. 6-4.
   Note: Before adjusting R74, turn R74 to fully clockwise position then adjust the potentiometer.

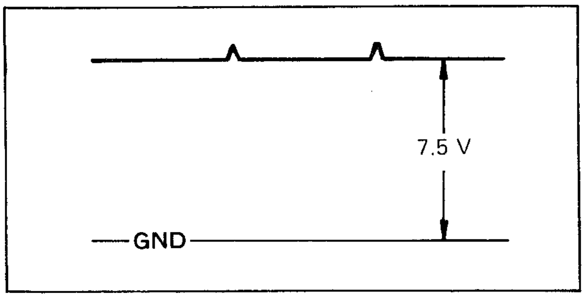
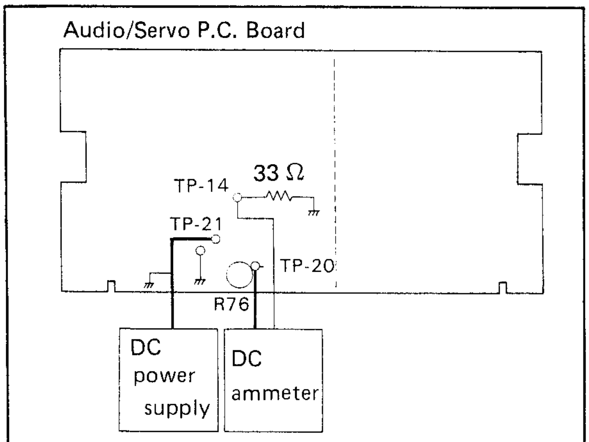


Fig. 6-4 Capstan sampling output

6-3-3 Adjustment of capstan discriminator gain

1. Turn off the power switch.
2. Connect TP-12 to ground.
3. Connect TP-14 (CAP. INVERT. IN) on servo circuit of Audio/Servo printed circuit board to ground with 33 Ω resistor as shown in Fig. 6-5.
4. Connect the DC power supply to TP-21 (CAP. M.D.A. OUT) and supply 1.5 volts DC. In this time, stop the DC motor by hand.
5. Connect the DC ampere-meter between TP-14 (CAP. INVERT. IN) and TP-20 (CAP. NON-INVERT. IN).
6. Adjust R76 (CAP. DISCRIMINATOR), so that vibration of meter's needle may be the least.
   After this adjustment, check the subsection 6-3-2 again.



NOTE : Stop the DC motor rotation by hand

Fig. 6-5

6-3-4 Adjustment of tape speed

1. Play back the JVC alignment tape to reproduce the audio 3-kHz signal.
2. Connect the frequency counter to TP-15 (AUDIO OUT) on audio circuit of Audio/Servo printed circuit board.
3. Check that the frequency of TP-15 is 3000 Hz ±0.3%.

– DRUM SERVO CIRCUIT –

6-3-5 Drum sampling waveform check

1. Set the unit to record mode with video signal as input.
2. Connect the oscilloscope to TP-7 (DRUM SAMPLING) on servo circuit of Audio/Servo printed circuit board.
3. Check the reference signal position as shown in Fig. 6-6.
4. If no reference signal appeared on TP-7 check the following:
   - Input video signal
     Connect the oscilloscope to TP-2 (VIDEO IN) and check the input video signal as shown in Fig. 6-7.
   - Sync separator out
     Connect the oscilloscope to TP-1 (SYNC OUT) and check the level of waveform as shown in Fig. 6-8.

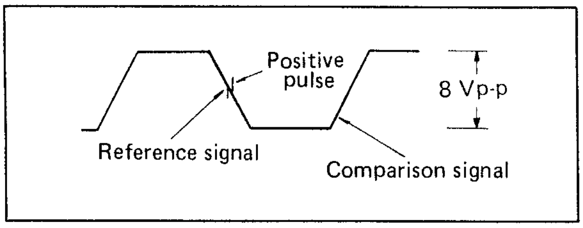


Fig. 6-6 Drum sampling waveform

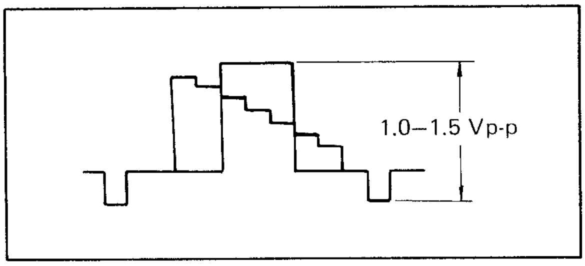


Fig. 6-7 Input video signal

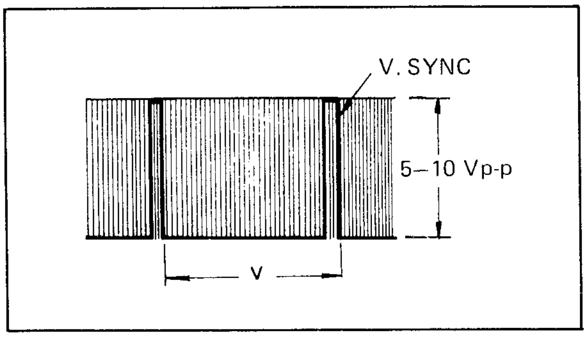

V. SYNC
5–10 Vp-p
V

Fig. 6-8 Sync separator out

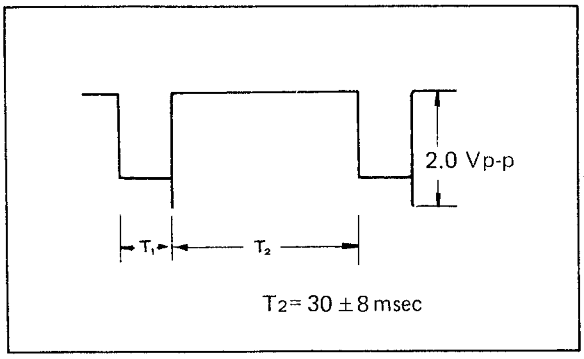

2.0 Vp-p
T₁
T₂
T2= 30 ± 8 msec

Fig. 6-9 Recording control signal

- Recording control signal
  Connect the oscilloscope to TP-3 (CTL OUT) and check the waveform as shown in Fig. 6-9.

5. If no comparison signal (sawtooth waveform) appears at TP-7 check the following:
   - Drum pulse
     Connect the oscilloscope to TP-4 (DRUM PULSE IN) and check the negative level of pulse as shown in Fig. 6-10.
   - Flip-Flop
     Connect the oscilloscope to TP-5 (DRUM F.F. OUT) and check the waveform as shown in Fig. 6-11.
6. If reference signal is not locked on the comparison signal at TP-7, the drum servo circuit has improper adjustment or has failed, so that the re-adjustment or repair is needed.

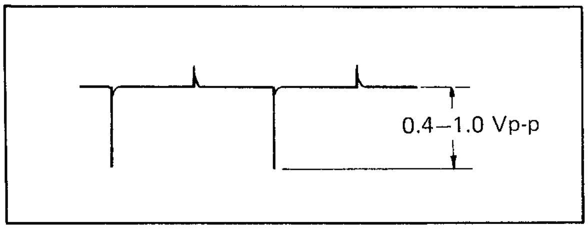


Fig. 6-10 Drum pulse

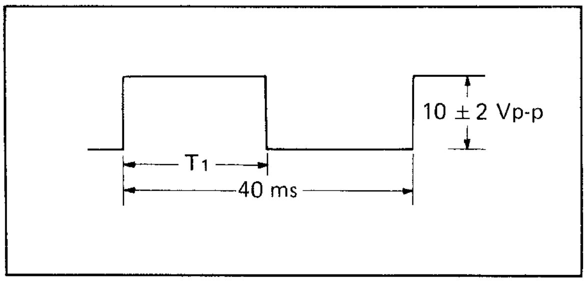
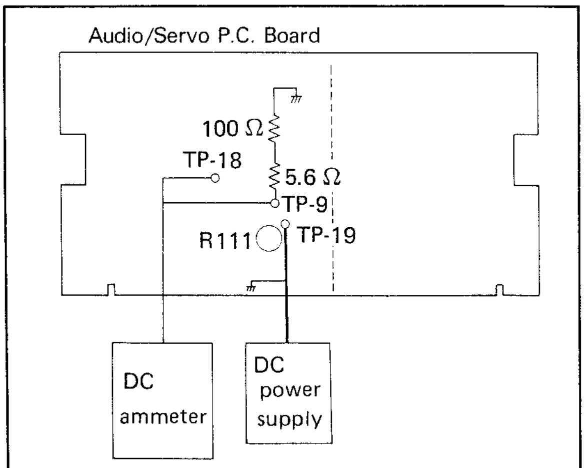

10 ± 2 Vp-p
T1
40 ms

Fig. 6-11 Drum Flip-Flop

6-3-6 Drum discriminator gain adjustment

1. Turn off the power switch.
2. Connect 100 Ω and 5.6 Ω resistors between TP-9 (DRUM INVERT IN) and ground as shown in Fig. 6-12.
3. Connect the DC power supply to TP-19 (DRUM M.D.A. IN) and supply 1.5 volt DC. At this time, when the drum motor rotates, stop the motor rotation by hand.
4. Connect the DC ammeter between TP-9 (DRUM INVERT IN) and TP-18 (DRUM NON-INVERT IN) as shown in Fig. 6-12.
5. Adjust R111 (DRUM DISCRI.), so that vibration of meter's needle may be the least.


Audio/Servo P.C. Board
100 Ω
TP-18
5.6 Ω
TP-9
R111
TP-19
DC ammeter
DC power supply

NOTE : Stop the DC motor by hand.

Fig. 6-12

6-3-7 Drum free-running adjustment

1. Set the unit to record mode then press the PAUSE key with no video signal as input.
2. Connect the external sync connector on the oscilloscope to TP-5 (DRUM F.F. OUT) of the servo circuit.
3. Connect the oscilloscope to video signal from the signal generator and adjust R58 (DRUM SAMPLING POSITION) so that the video signal is synchronized with external sync signal as shown in Fig. 6-13.

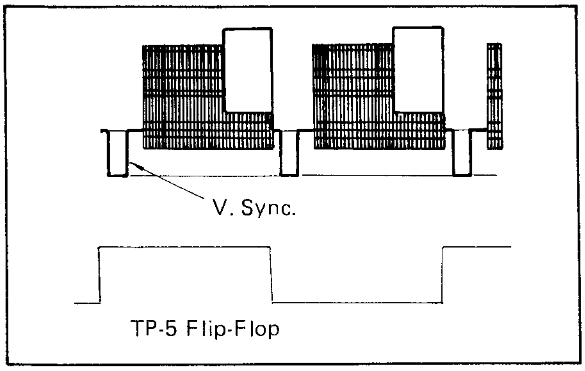


Fig. 6-13 Drum motor free running adjustment

6-3-8 Drum motor input check

1. Set the unit to record mode with video signal as input.
2. After the servo circuit locked, connect the oscilloscope to TP-9 (DRUM INVERT).
3. Verify the DC level of TP-9 is within the range; 6–8 volts.
4. Then set the unit to play mode then press the PAUSE key and verify AC ripple of TP-9 as shown in Fig. 6-14. If 1–2 volts AC ripple appears on TP-9, the drum DC motor will have replaced.

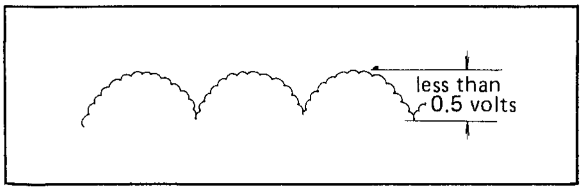


Fig. 6-14

6-3-9 Playback switching point adjustment

1. Play back the JVC alignment tape MH-2 to reproduce the stair-step segment.
2. Connect the external sync connector on the oscilloscope to TP-5 (DRUM F.F. OUT) of the servo circuit.
3. Connect the oscilloscope to TP-2 (VIDEO IN) on the servo circuit of the Audio/Servo printed circuit board, and adjust R29 (CH-1 SW PHASE) so that the switching point is 5.5 to 7.5 H before the vertical sync signal as shown in Fig. 6-15.
4. Next adjust R33 (CH-2 SW PHASE) so the switching points from a single line.

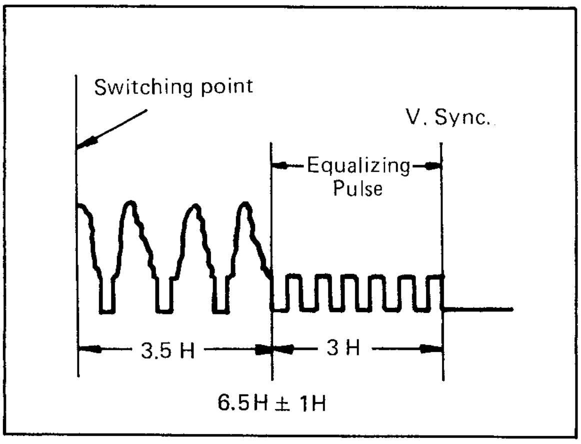


Fig. 6-15 Switching point adjustment

6-3-10 Recording switching point adjustment

1. Set the unit to the record mode with the video signal as input.
2. Connect the external sync connector on the oscilloscope to TP-5 (DRUM F.F. OUT) of the servo circuit.
3. Connect the oscilloscope to TP-2 (VIDEO IN) of the servo circuit, then set the switching point to be 5.5–7.5 H prior to the vertical sync signals by adjusting R9 (SW POINT) on the servo circuit.
4. Finally, record then play back the video signal, and check that the switching point is in correct position.

6-3-11 Tracking control adjustment

1. Record then play back the video signal.
2. Connect the oscilloscope to TP-7 (P.B. FM OUT) on the pre-amplifier circuit of the Pre/Record amplifier printed circuit board.
3. Set the tracking control knob to AUTO position and adjust R22 (PRE-SET) so that the FM waveform on TP-7 is maximum as shown in Fig. 6-16.

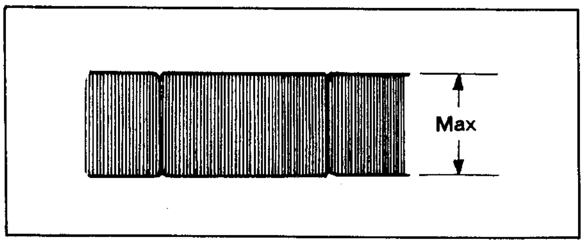


Fig. 6-16 FM waveform

4. Play back the JVC alignment tape to reproduce the stair-step segment.
5. Chwck the FM waveform on TP-7, so that the FM level is maximum at the tracking AUTO position.

6-3-12 Playback control signal check

1. Play back the JVC alignment tape to reproduce the stair-step segment.
2. Connect the oscilloscope to TP-3 (CTL OUT) on servo circuit of the Audio/Servo printed circuit board.
3. Verify the negative pulse of the control signal as shown in Fig. 6-17.
4. Record then play back the video signal, and verify the pulse level as same as step 3.

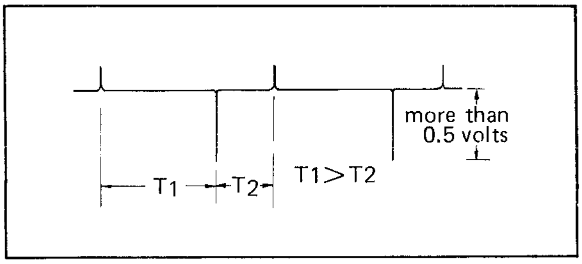


Fig. 6-17 Control signal

6-3-13 Drum sampling position check

1. Record then play back the video signal.
2. Connect the oscilloscope to TP-7 on the servo circuit and verify the waveform during recording and playback as shown in Fig. 6-18.
   RECORDING: Down ramp of sawtooth wavefrom (T) is 5 ± 1.5 ms.
   PLAYBACK : Down ramp of the sawtooth waveform (T) is 10 ± 2.5 ms.
3. Check the position of drum sampling pulse and stability of the pulse at the center of ramp.

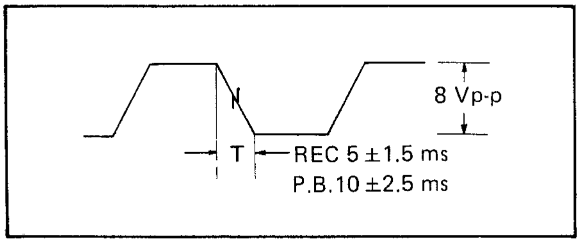


Fig. 6-18 Drum sampling waveform

6-3-14 Lock-in time check

1. Record, then play back the video signal.
2. Check for a period of 8 seconds or less, from the time tape traveling is begins in the Play mode, until the time a stable picture appears on the TV screen.

6-4 LUMINANCE AND CHROMINANCE SIGNAL RECORDING SYSTEM

Refer to Fig. 6-43 "Luminance/Chrominance (Y/C) amplifier printed circuit board and Fig. 6-42 "Pre/Record amplifier printed circuit board.

6-4-1 Adjustment of video head resonance and Q (quality factor)

1. Connect the oscilloscope to TP-4 (CH-1 FM OUT) on the pre-amplifier circuit of the Pre/Record amplifier printed circuit board.
2. Play back the JVC alignment tape to reproduce the RF segment.
3. Adjust C18 (CH-1 Fo ADJ.) so that the peak resonance at the marker (5.0 MHz) becomes as shown in Fig. 6-19.

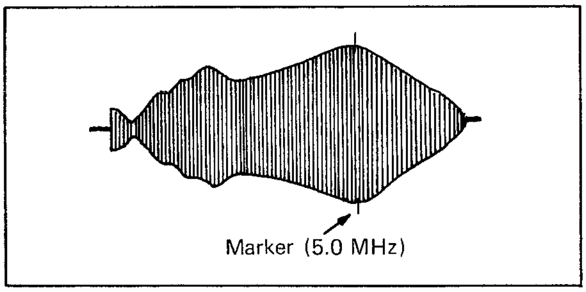


Fig. 6-19 RF signal

4. Connect the oscilloscope to TP-5 (CH-2 FM OUT) on the pre-amplifier circuit.
5. Adjust C19 (CH-2 Fo ADJ.) in the same manner as above (CH-1 adjustment).
6. Play back the JVC alignment tape to reproduce the colour bar segment.
7. Connect the oscilloscope to TP-4 and 5 on pre-amplifier circuit of Pre/Record amplifier printed circuit board and play back the colour bar signal.
8. Check that the waveform between the channels as shown in Fig. 6-20, if there is a difference between the channels, adjust the waveform to be equal by using R33 (CH-1 HEAD Q) and R34 (CH-2 HEAD Q).

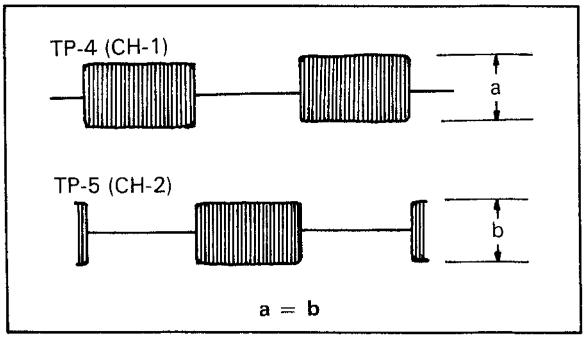


Fig. 6-20 Playback FM signal

6-4-2 FM channel balance adjustment

1. Play back the JVC alignment tape to reproduce the colour bar segment.
2. Connect the oscilloscope to TP-7 (P.B. FM OUT) on the pre-amplifier of the Pre/Record amplifier printed circuit board.
3. Adjust the tracking control knob so that the amplitude of the waveform is maximum.
4. Adjust R48 (FM CH. BALANCE) so that the amplitude of (a) and (b) in Fig. 6-21 are equal to each other.

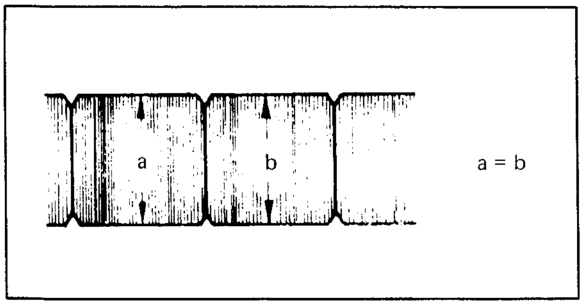


Fig. 6-21 FM channel balance

6-4-3 Limiter and carrier balance adjustment

1. Play back the JVC alignment tape to reproduce the colour bar segment.
2. Connect the oscilloscope to TP-9 (DEMOD. OUT) on the luminance circuit.
3. Adjust R104 (LIMITER BAL.-2) and R95 (CARRIER BAL.) so that the peak white (a) and sync tip (b) becomes a single line as shown in Fig. 6-22.
   Note: Do not adjust the R87 (LIMITER BAL-1) potentiometer.

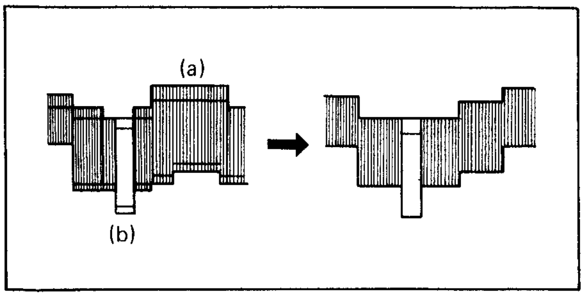


Fig. 6-22 Limiter and Carrier balance

6-4-4 Playback video level adjustment

1. Play back the JVC alignment tape to reproduce the colour bar segment.
2. Connect the oscilloscope to TP-6 (VIDEO OUT) on the luminance circuit.
3. Adjust R28 (P. B. OUT LEVEL) so that the level of TP-6 is 2.0 Vp-p as shown in Fig. 6-23.

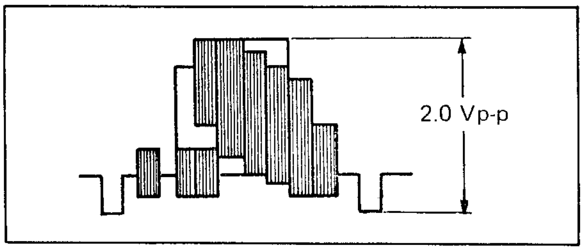


Fig. 6-23 Video output (without load)

6-4-5 Aperture adjustment

1. Play back the JVC alignment tape to reproduce the colour bar segment.
2. Connect the oscilloscope to TP-6 (VIDEO OUT) on the luminance circuit.
3. Adjust R45 (APERTURE) so that the amplitude of (a) becomes as shown in Fig. 6-24.
4. After adjustment, record then play back the video signal and verify the picture on the monitor.

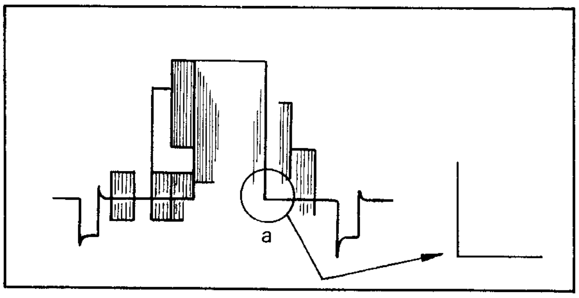


Fig. 6-24 Aperture adjustment

6-4-6 Carrier and deviation adjustment

1. Set the unit to Record mode with stair-step signal as input.
2. Connect the oscilloscope to TP-6 (VIDEO OUT) on the luminance circuit and TP-1 (REC FM OUT) on the Pre/Record board, and set the oscilloscope to "A + B" mode.
3. Connect a high-frequency sine-wave generator output to TP-7 (MOD. OUT) on the luminance circuit.
4. Before adjustment, turn R4 (WHITE CLIP) and R17 (DARK CLIP) to fully counterclockwise position, so that the signal is not limited.
5. Set the frequency of high-frequency sine-wave generator to 3.8 MHz, and adjust R10 (CARRIER SET) so that the waveform observed at the oscilloscope shows a zero beat at the bottom of the waveform as shown in Fig. 6-25.
6. Set the frequency of high-frequency sine-wave generator to 4.8 MHz, and adjust R27 (DEVIATION), so that the waveform observed on the oscilloscope shows a zero beat at the top of the video signal as shown in Fig. 6-26.
7. Then adjust the subsection 6-4-7 "White and dark clip adjustment".

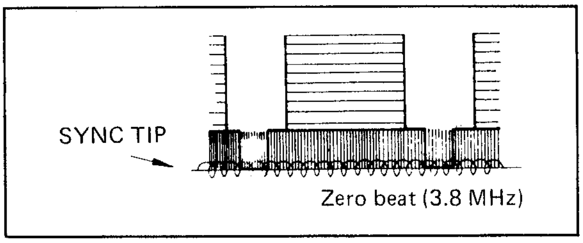


Fig. 6-25 Carrier and deviation adjustment

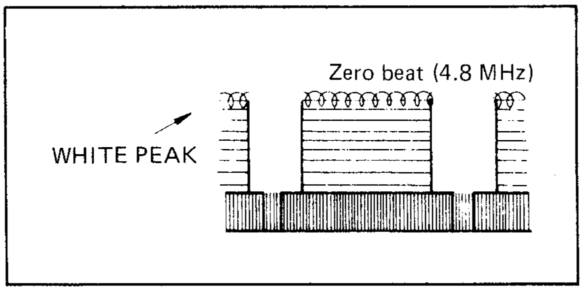
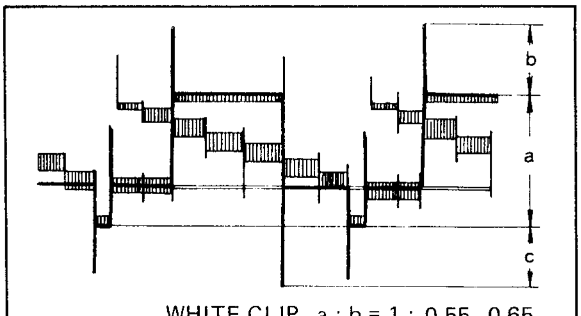


Fig. 6-26

6-4-7 White and dark clip adjustment

1. Set the unit to Record mode with color bar signal as input.
2. Connect the oscilloscope to TP-1 (PRE-EMPHA. OUT) on the luminance circuit of the Y/C (Luminance/Chrominance signal) printed circuit board.
3. Adjust R4 (WHITE CLIP), so that the amplitude ratio of transient "spikes" with white clip becomes as shown in Fig. 6-27.
4. Adjust R17 (DARK CLIP), so that the amplitude ratio of the transient "spikes" with dark clip becomes as shown in Fig. 6-27.



WHITE CLIP a : b = 1 : 0.55–0.65
DARK CLIP a : c = 1 : 0.45–0.55

Fig. 6-27 White and dark clip adjustment

6-4-8 FM record level adjustment

1. Set the unit to Record mode with video signal as input.
2. Connect the oscilloscope to TP-1 (REC OUT) on the record amplifier circuit of the Pre/Record amplifier printed circuit board.
3. Adjust R1 (FM REC LEVEL), so that the level of TP-1 is 3 Vp-p as shown in Fig. 6-28.

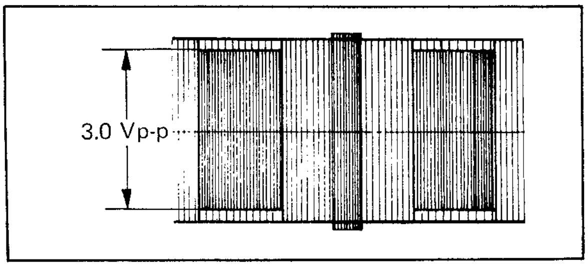


Fig. 6-28 FM record level

6-4-9 Video output level (E-to-E) adjustment

1. Set the unit to Record mode with colour bar signal as input.
2. Connect the oscilloscope to TP-6 (VIDEO OUT) on the luminance circuit of the Y/C (Luminance/Chrominance amplifier) printed circuit board.
3. Adjust R58 (E-E LEVEL), so that the level of TP-6 is 2.0 Vp-p (with no load).

6-4-10 Drop-out compensator (D.O.C.) adjustment

1. Set the unit to Record mode with video signal as input and then play back it.
2. Connect the oscilloscope to TP-5 (D.O.C. OUT) on the luminance circuit.
3. Adjust R55 (FM LEVEL) of the Pre/Record board, so that the level of TP-5is 0.45 Vp-p as shown in Fig. 6-29.

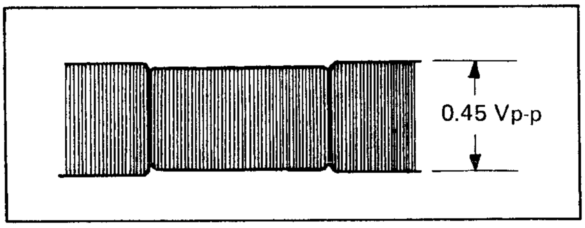


Fig. 6-29

6-5 COLOUR SIGNAL SYSTEM ADJUSTMENT

Refer to Fig. 6-43 "Luminance/Chrominance (Y/C) amplifier printed circuit board", and Fig. 6-42 "Pre/Record amplifier printed circuit board".

6-5-1 Oscillating frequency (4.43 MHz) adjustment

1. Connect the frequency counter to TP-215 (4.43 MHz X'TAL OSC. OUT) on the colour circuit.
2. Play back the JVC alignment tape to reproduce the colour bar segment.
3. Adjust C295 (4.43 MHz OSC.) so that the frequency of TP-215 is 4.433619 MHz ± 30 Hz.

6-5-2 Variable crystal oscillator (4.43 MHz) adjustment

1. Set the unit to Record mode.
2. Connect the frequency counter to TP-209 (SUB

CONV. 4.43 MHz IN) on the colour circuit.

3. Adjust R249 (V.X.O.) so that the frequency of TP-219 is 4.435571 MHz ±30 Hz.

6-5-3 AFC detector reference signal input adjustment

1. Set the unit to Record mode with colour bar signal as input.
2. Connect the oscilloscope to TP-218 (REFERENCE FH OUT) on the colour circuit.
3. Adjust R301 (DUTY) so that the pulse width of TP-218 is as shown in Fig. 6-30.

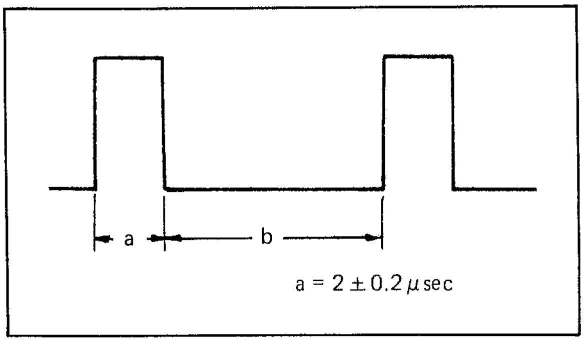


Fig. 6-30 AFC Detector reference signal

6-5-4 AFC detector comparison signal input adjustment

1. Set the unit to Record mode with colour bar signal as input.
2. Connect the CH-1 probe on the oscilloscope to TP-218 on the colour circuit and connect the CH-2 probe to TP-214.
3. Set the oscilloscope to CHOP mode.
4. Adjust R311, so that the timing of TP-214 and TP-218 is 4 ± 0.2 μsec from the trigger point as shown in Fig. 6-31.

Note: Subsections 6-5-1, 6-5-2, 6-5-3, 6-5-4, describe very important adjustments for the color A.P.C. and A.F.C. circuits, so check these sections first then adjust the colour circuit.

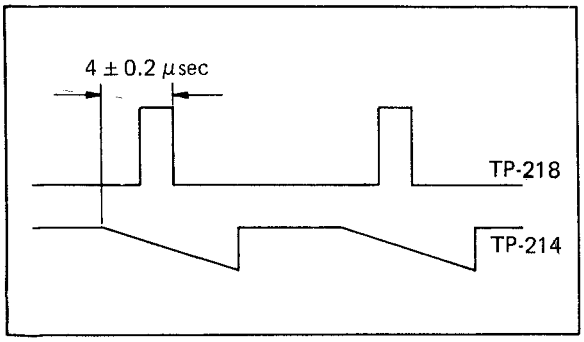


Fig. 6-31 AFC Detector comparison signal

6-5-5 Playback colour channel balance adjustment

1. Play back the JVC alignment tape to reproduce the colour bar segment.
2. Connect the oscilloscope to TP-6 (P. B. COLOUR OUT) on the pre-amplifier circuit of Pre/Rec amplifier circuit board.
3. Adjust the levels to be equal by using R49 (P.B. COLOUR CH. BALANCE) as shown in Fig. 6-32.

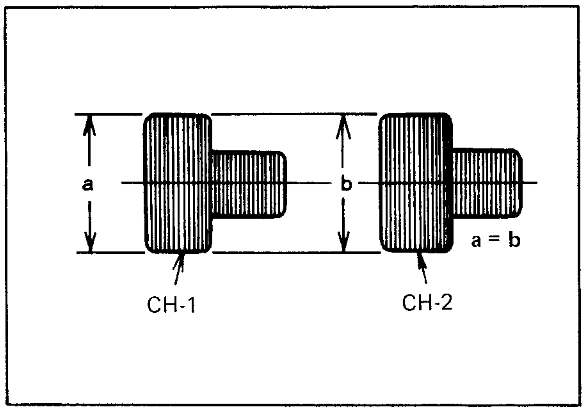


Fig. 6-32 Playback colour channel balance

6-5-6 Playback colour level adjustment

1. Play back the JVC alignment tape to reproduce the colour bar segment.
2. Connect the oscilloscope to TP-202 (P.B. COLOUR OUT) on the colour circuit of the Y/C (Luminance/Chrominance) printed circuit board.
3. Adjust R52 (P.B. COLOUR LEVEL) of Pre/Record board so that the level of TP-202 is 0.2 ± 0.05 Vp-p as shown in Fig. 6-33.

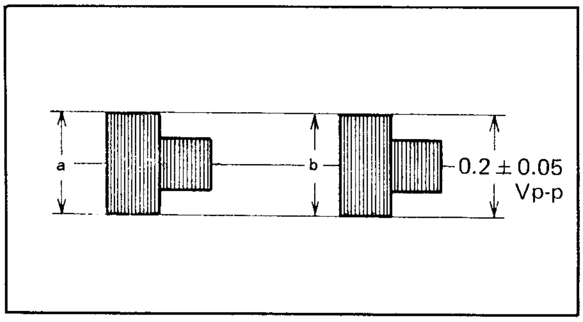


Fig. 6-33 Color record level

6-5-7 Main converter balance adjustment

1. Play back the JVC alignment tape to reproduce the colour bar segment.
2. Connect the oscilloscope to TP-206 (P.B. COLOUR OUT) on the colour circuit of the Luminance/Chrominance printed circuit board.
3. Adjust R216 (CONV. BAL.) so that the carrier leak of TP-206 is minimum as shown in Fig. 6-34.

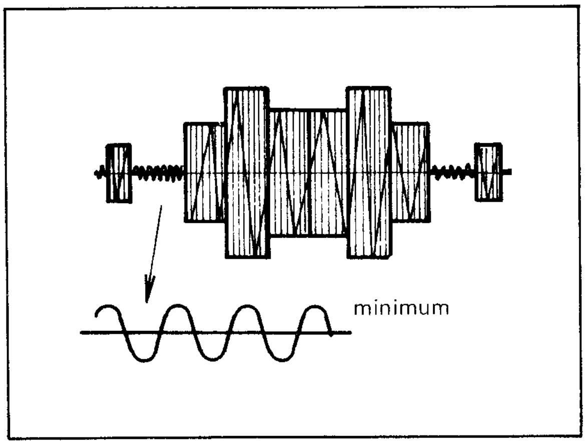


Fig. 6-34 Main converter balance adjustment

6-5-8 Playback colour output level adjustment

1. Play back the JVC alignment tape to reproduce the colour bar segment.
2. Connect the oscilloscope to TP-6 (VIDEO OUT) on the Y/C (Luminance/Chrominance) printed circuit board.
3. Adjust R215 (COLOUR OUT) so that the level of colour burst signal is 0.5 Vp-p (with no load) as shown in Fig. 6-35.

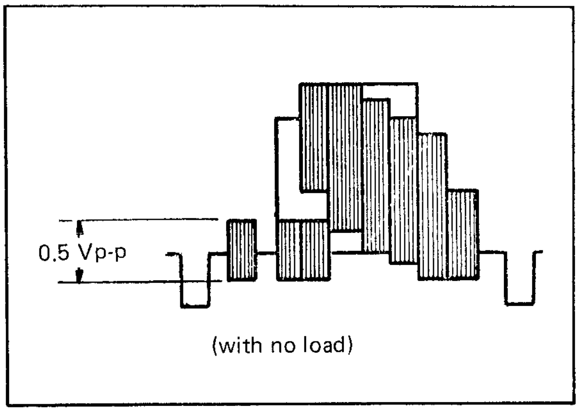


Fig. 6-35 Playback color output level adjustment

6-5-9 Colour recording level and channel balance adjustment

1. Set the unit to Record mode with colour bar signal as input.
2. Connect the oscilloscope to TP-202 (P.B.COLOUR OUT) on the Y/C circuit board.
3. Adjust R24 (COLOUR REC BALANCE) during Record mode then perform playback, so that the colour levels to be equal.
4. Adjust R2 (COLOUR LEVEL) on the record amplifier circuit during Record mode, then play back it, so that the level of TP-202 is 0.2 ± 0.05 Vp-p as shown in Fig. 6-36.

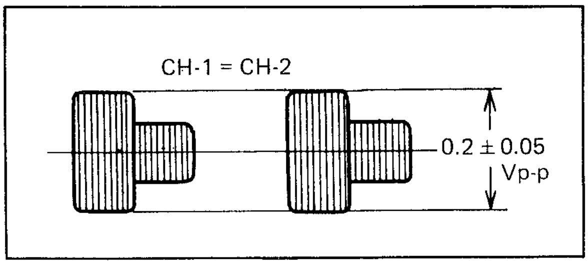


Fig. 6-36 Colour level

6-5-10 FM channel balance check

1. Set the unit to Record mode with video signal as input, then play it back.
2. Connect the oscilloscope to TP-7 (P.B. FM OUT) on the pre-amplifier circuit.
3. Check the level difference between the channels is within 3 dB as shown in Fig. 6-37.

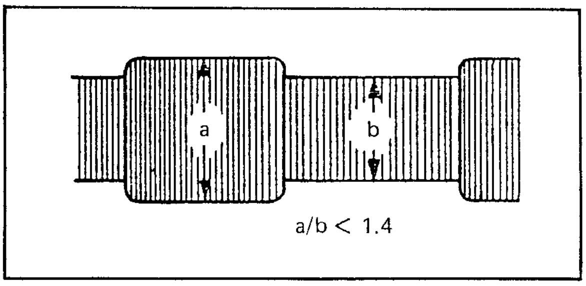


Fig. 6-37 FM channel balance

6-5-11 Record colour killer adjustment

1. Connect the DC voltmeter to TP-211 on the Luminance and Chrominance (Y/C) board and set the Video mode switch to AUTO position.
2. Set the unit to Record mode with colour bar signal as input.
3. Then connect an attenuator between the TP-201 and the ground as shown in Fig. 6-38.

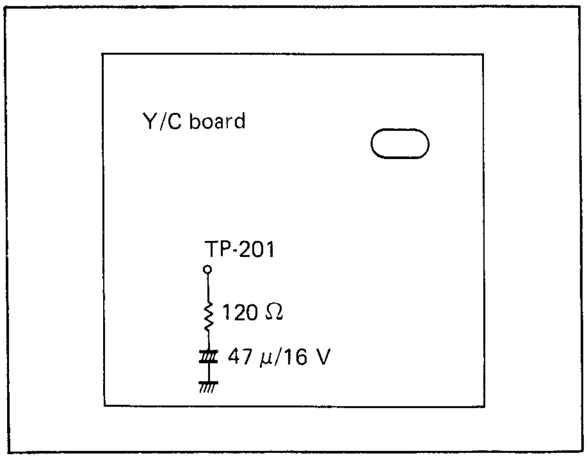


Fig. 6-38 Record colour killer

4. Adjust R283 (REC COLOUR KILLER) until high voltage (10–11 volts DC) is appeared.
5. Remove the attenuator and check the high voltage is present at TP-211 with the black and white signal.
6. Then connect the DC voltmeter to TP-10 of the luminance and chrominance (Y/C) board.
7. Check the DC potential at TP-10.

P.B. MODE SW	TP-10
COLOUR	Low
AUTO	
B/W	High (more than 8 V DC)

6-5-12 2-H Delay line filter adjustment

1. Set the unit to Record mode with colour bar signal as input, then play it back.
2. Connect the oscilloscope to TP-208 on the Luminance and Chrominance (Y/C) board.
3. Adjust R238 and L205 several times, so that the level of TP-208 is minimum.

6-6 AUDIO AMPLIFIER CIRCUIT ADJUSTMENT

Refer to Fig. 6-44 "Audio/Servo amplifier printed circuit board".

6-6-1 Playback level adjustment

1. Play back the JVC alignment tape MH-2 to reproduce the colour bar segment.
2. Connect the oscilloscope to TP-15 (AUDIO OUT) on the audio amplifier circuit.
3. Adjust R146 (P.B. LEVEL) so that the level of TP-15 is 2.2 V p-p (0 dB) as shown in Fig. 6-39.

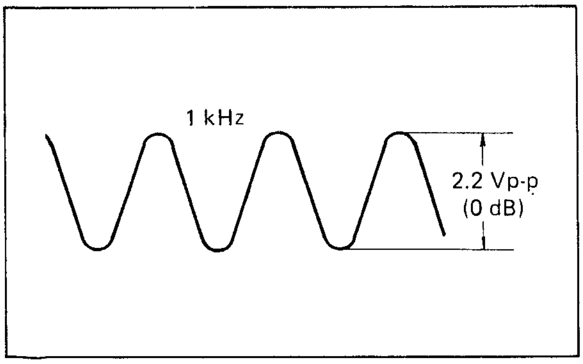


Fig. 6-39 Playback level

6-6-2 E-to-E level adjustment

1. Set the unit to Record mode with 1 kHz sine-waveform, 0.22 V p-p (–20 dB) as input.
2. Connect the oscilloscope to TP-15 (AUDIO OUT) on the audio amplifier circuit.
3. Adjust R132 (E-E LEVEL) so that the level of TP-15 is 2.2 V p-p.

6-6-3 Bias level adjustment

1. Set the unit to Record mode.
2. Connect the oscilloscope to TP-16 (AUDIO HEAD IN) on the audio circuit.
3. Adjust R174 (BIAS LEVEL) so that the level of TP-16 is 70 Vp-p and also, check TP-17 (F.E.H. IN) is 55 Vp-p as shown in Fig. 6-40.

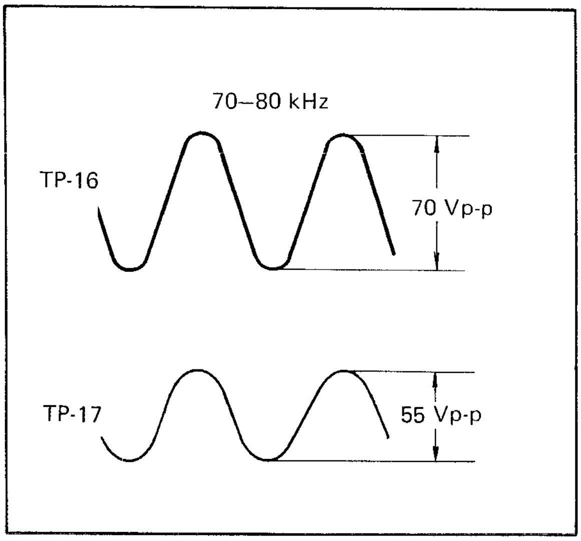


Fig. 6-40 Bias level

6-6-4 Bias leak adjustment

1. Set the unit to Record mode with no signal as input.
2. Connect the oscilloscope to TP-15 (AUDIO OUT) on the audio circuit.
3. Adjust L2 so that the leak of bias on TP-15 is minimum (less than 0.2 V p-p).

6-6-5 Record level adjustment

1. Set the unit to Record mode with 1 kHz sine-waveform signal, 0.22 V p-p (–20 dB) as input.
2. Connect the oscilloscope to TP-15 (AUDIO OUT) on the audio amplifier circuit.
3. Adjust R154 (REC LEVEL) during record mode, then play it back so that the level of TP-15 is 2.2 V p-p at the playback mode.

6-7 LOCATION OF POTENTIOMETERS AND TEST POINTS

6-7-1 Regulator printed circuit board

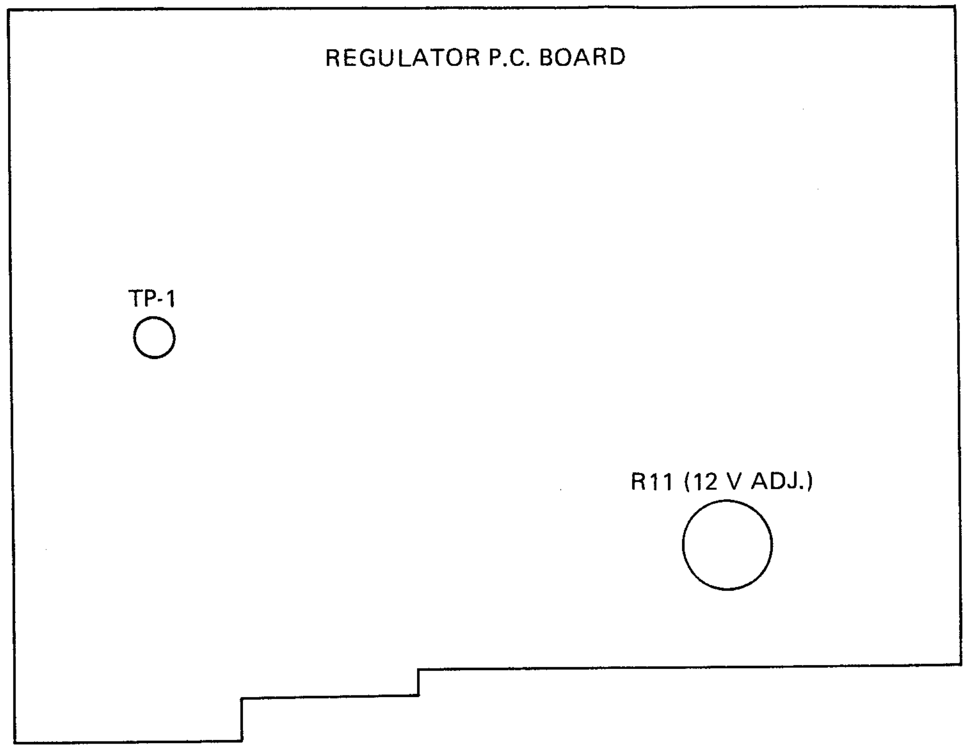

REGULATOR P.C. BOARD
TP-1
R11 (12 V ADJ.)

Fig. 6-41 Regulator printed circuit board

6-7-2 Pre/Record (PRE/REC) amplifier printed circuit board

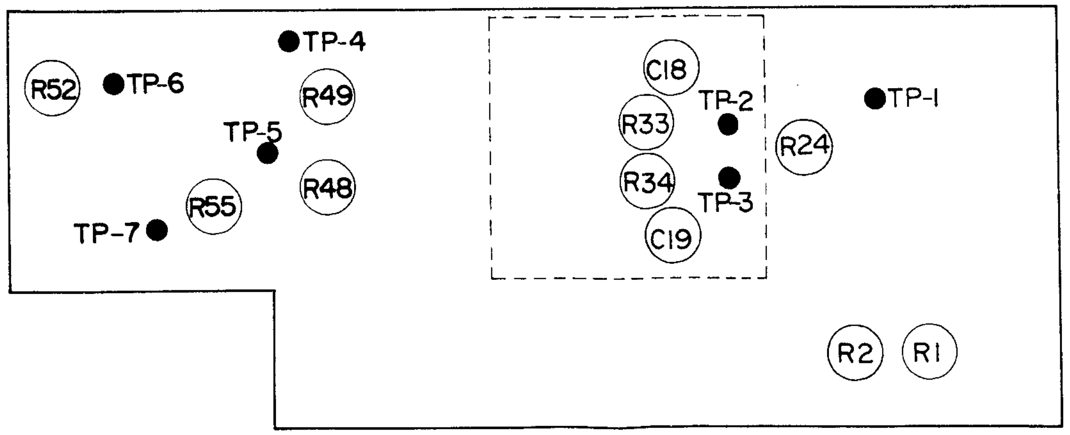

TP-4
R52
TP-6
R49
TP-5
R48
R55
TP-7
C18
TP-2
R33
R24
TP-I
R34
TP-3
C19
R2
RI

Fig. 6-42 Pre/Record (PRE/REC) amplifier printed circuit board

6-7-3 Luminance/Chrominance (Y/C) amplifier printed circuit board

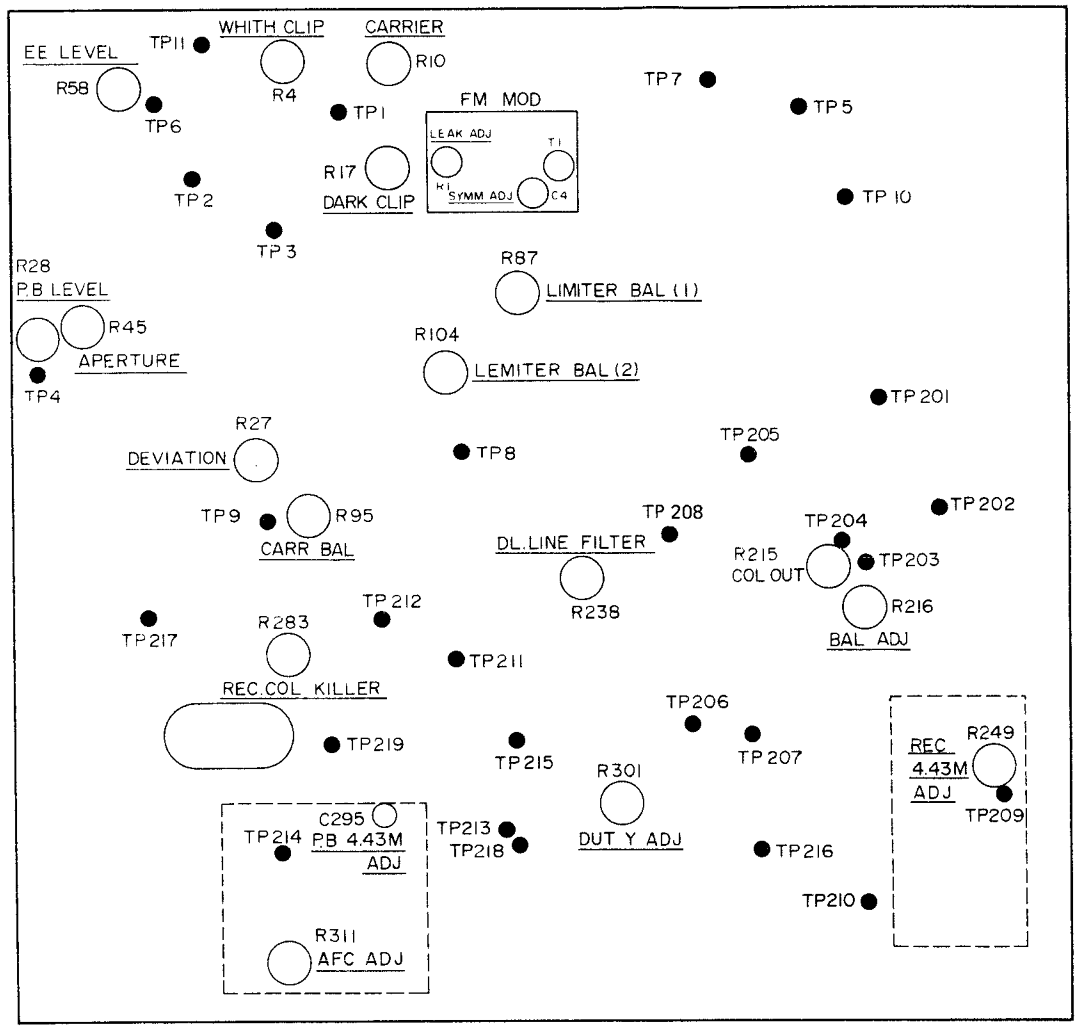

EE LEVEL
R58
TP11
TP6
WHITH CLIP
R4
CARRIER
R10
TP1
FM MOD
LEAK ADJ
T1
SYMM ADJ
C4
R17
DARK CLIP
TP2
TP3
TP7
TP5
TP 10
R28
P.B LEVEL
R45
APERTURE
TP4
R87
LIMITER BAL (1)
R104
LEMITER BAL (2)
TP201
R27
DEVIATION
TP8
TP205
TP9
R95
CARR BAL
TP 208
DL.LINE FILTER
R238
TP204
R215
COL OUT
TP203
TP202
R216
BAL ADJ
TP217
R283
TP 212
REC.COL KILLER
TP211
TP206
TP207
TP219
TP215
R301
DUT Y ADJ
REC
4.43M
ADJ
R249
TP209
C295
TP214
PB 4.43M
ADJ
TP213
TP218
TP216
TP210
R311
AFC ADJ

Fig. 6-43 Luminance/Chrominance printed circuit board.

6-7-4 Audio/Servo (A/S) amplifier printed circuit board

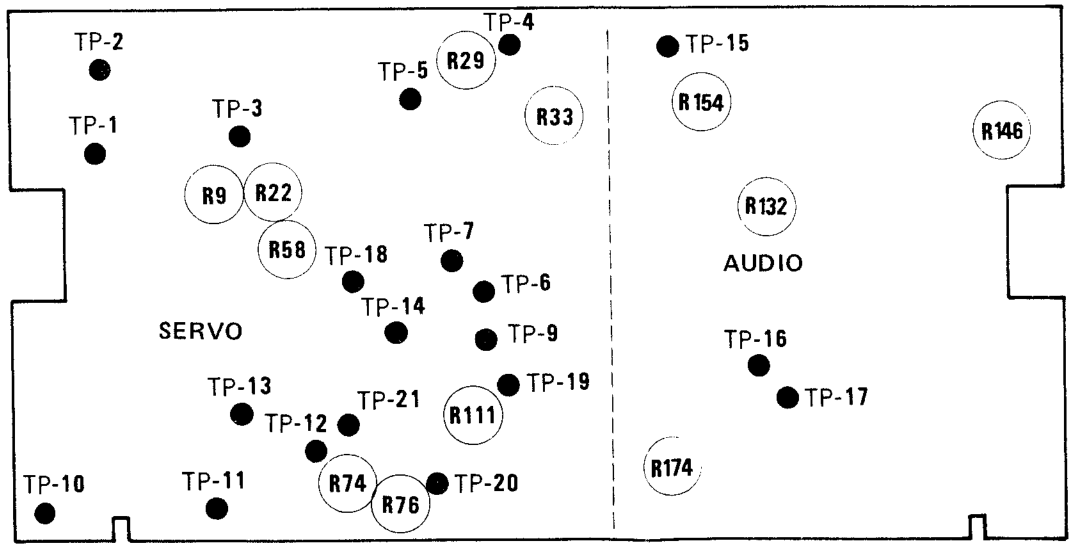

TP-2
TP-1
TP-3
TP-4
TP-5
R29
R33
R9
R22
R58
TP-18
TP-7
TP-6
TP-14
SERVO
TP-9
TP-13
TP-12
TP-21
R111
TP-19
TP-10
TP-11
R74
R76
TP-20
TP-15
R154
R146
R132
AUDIO
TP-16
TP-17
R174

Fig. 6-44 Audio/Servo (A/S) amplifier printed circuit board

SECTION 7
REPACKING

The proper repacking procedures are as follows.

1. Cover the HR-3300E ① with the plastic bag.
2. Insert the front cushion ② and rear cushion ⑧ to HR-3300E, and place the accessory parts ⑥ to bottom of the carton, then insert the HR-3300E into the cardboard carton ⑤ .
3. Place the accessory parts ⑨ on the HR-3300E.

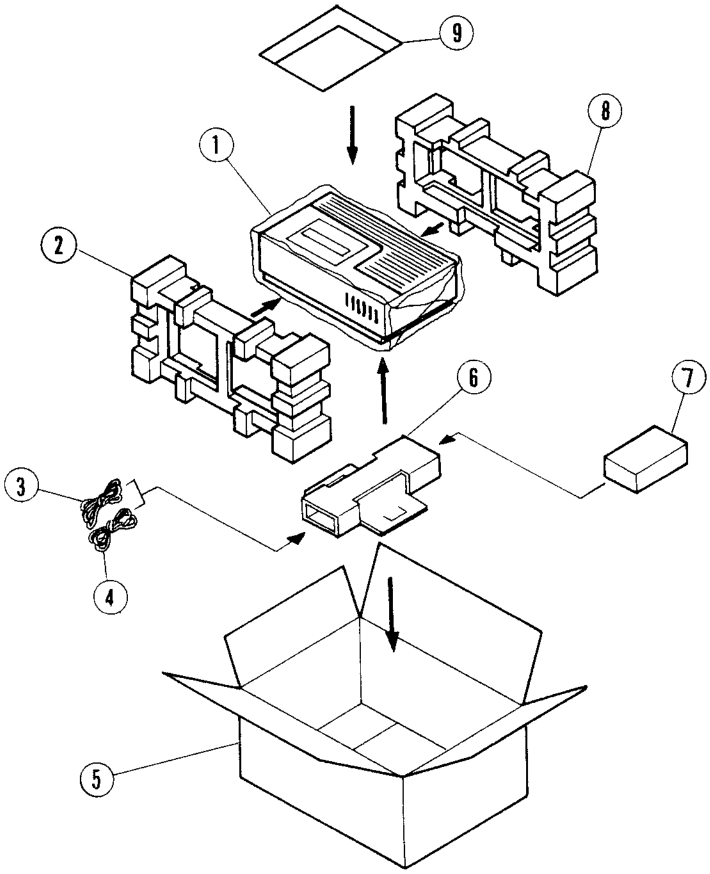


Fig. 7-1

Symbol No.	Part Name
1	HR-3300E
2	Front Cushion
3	Cable Ass'y
4	Power Cord
5	Cardboard Carton
6	Protector
7	Video Cassette
8	Rear Cushion
9	Accessories

SECTION 8
TROUBLESHOOTING GUIDE

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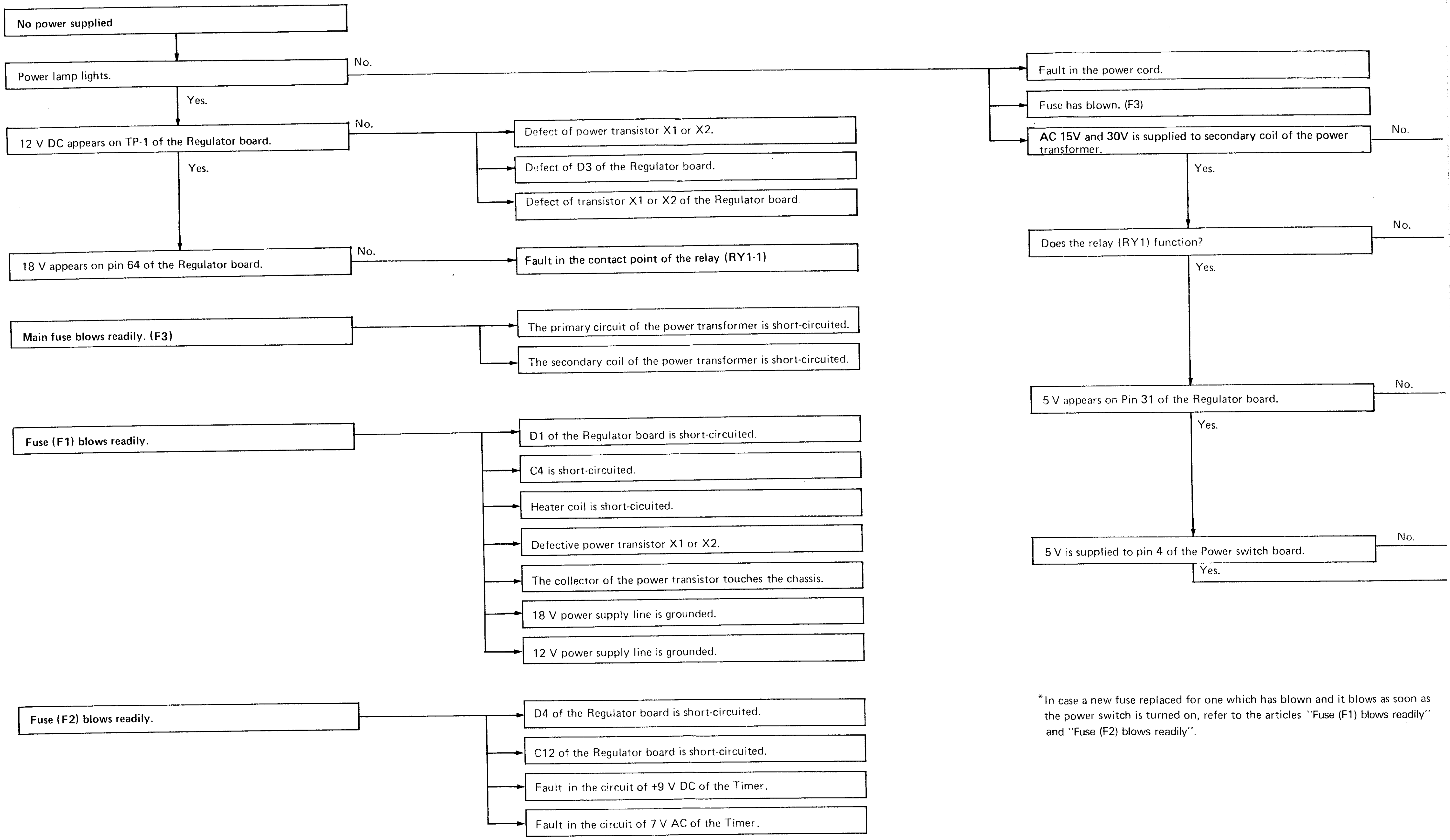
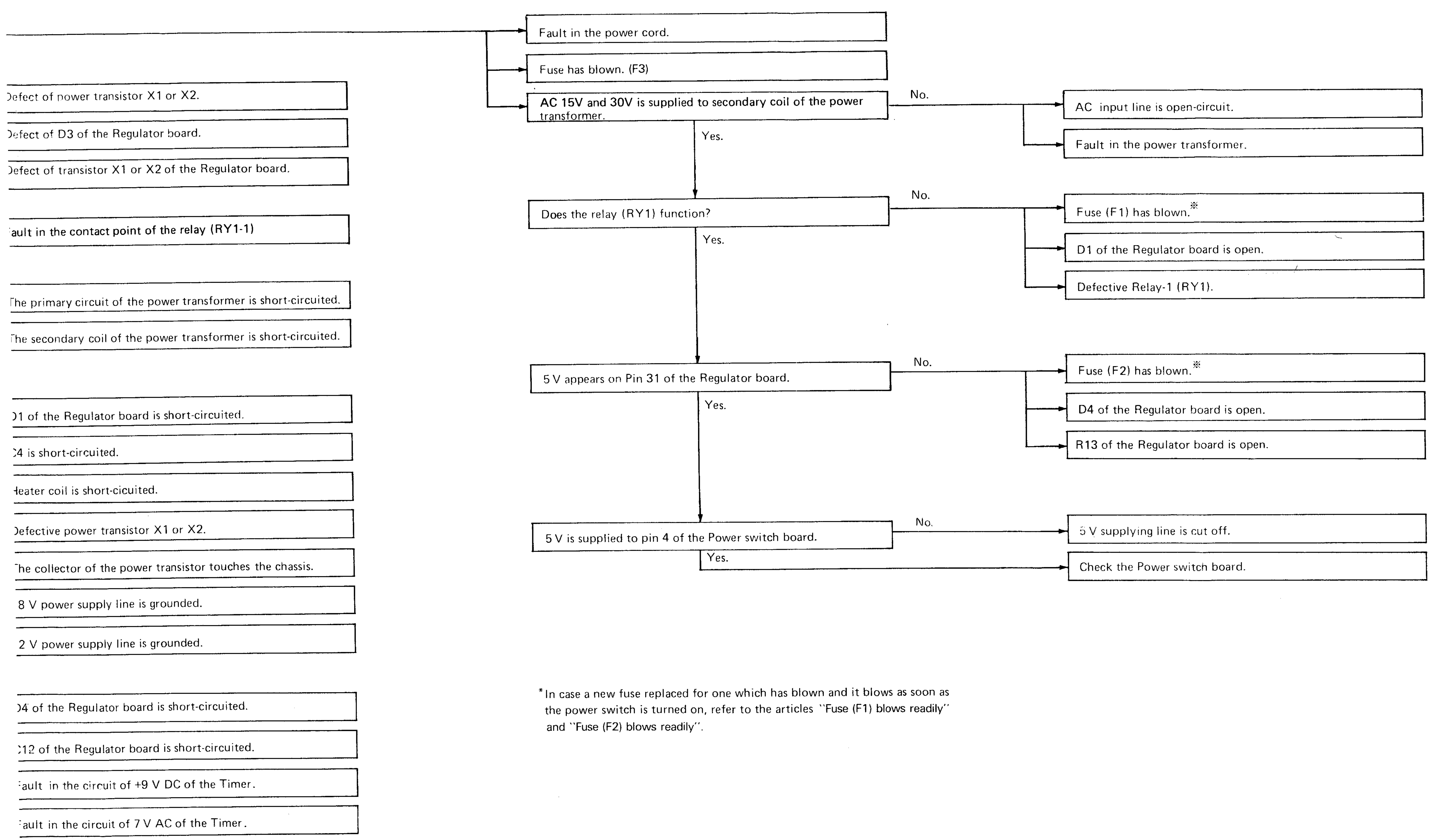
What may appear at first to be trouble is not always a real problem. Before repairing make sure first by following the troubleshooting procedure below:

1. HR-3300E power not present.
   - Is the HR-3300E power cord disconnected?
   - Is the power switch set to OFF? Set to ON position.
   - Is the operation switch set to TIMER/SLEEP? Set to OPERATE position.
2. No picture on the screen when viewing TV programs.
   - Is the TV/VIDEO switch set to VIDEO position? Set to TV position.
3. Playback picture does not appear while the tape is running.
   - Is the TV channel selector set to an unoccupied channel?
   - Is the VIDEO/TV switch set to TV position? Set to VIDEO position.
4. The tape does not run in the recording mode or picture does not appear in the playback mode.
   - Is the PAUSE key depressed? Depress again to release.
5. The REC or AUDIO DUB key cannot be depressed.
   - Is the cassette properly loaded in the compartment?
   - Is the safety tab of the video cassette broken?
6. The tape stops in the rewind mode.
   - Is the SEARCH button on?
7. Playback picture is partially noisy.
   - Is the TRACKING control knob properly adjusted? Turn until you hear the clicking sound. If the noise is still present, turn slowly until the picture clears.
8. Tape will not rewind or fast-forward.
   - Is the tape already rewound or fast-forwarded to the end?
9. Noise such as whistling or howling is heard from the TV.
   - Is the microphone located near the TV? Keep the microphone away from the TV or reduce the TV volume.
10. TV broadcasts cannot be recorded.
    - Is the REC SELECT switch set to TV?

8-1 REGULATOR CIRCUIT


No power supplied
Power lamp lights.
No.
Yes.
12 V DC appears on TP-1 of the Regulator board.
No.
Yes.
18 V appears on pin 64 of the Regulator board.
No.
Main fuse blows readily. (F3)
Fuse (F1) blows readily.
Fuse (F2) blows readily.
Defect of power transistor X1 or X2.
Defect of D3 of the Regulator board.
Defect of transistor X1 or X2 of the Regulator board.
Fault in the contact point of the relay (RY1-1)
The primary circuit of the power transformer is short-circuited.
The secondary coil of the power transformer is short-circuited.
D1 of the Regulator board is short-circuited.
C4 is short-circuited.
Heater coil is short-cicuited.
Defective power transistor X1 or X2.
The collector of the power transistor touches the chassis.
18 V power supply line is grounded.
12 V power supply line is grounded.
D4 of the Regulator board is short-circuited.
C12 of the Regulator board is short-circuited.
Fault in the circuit of +9 V DC of the Timer.
Fault in the circuit of 7 V AC of the Timer.
Fault in the power cord.
Fuse has blown. (F3)
AC 15V and 30V is supplied to secondary coil of the power transformer.
No.
Yes.
Does the relay (RY1) function?
No.
Yes.
5 V appears on Pin 31 of the Regulator board.
No.
Yes.
5 V is supplied to pin 4 of the Power switch board.
No.
Yes.

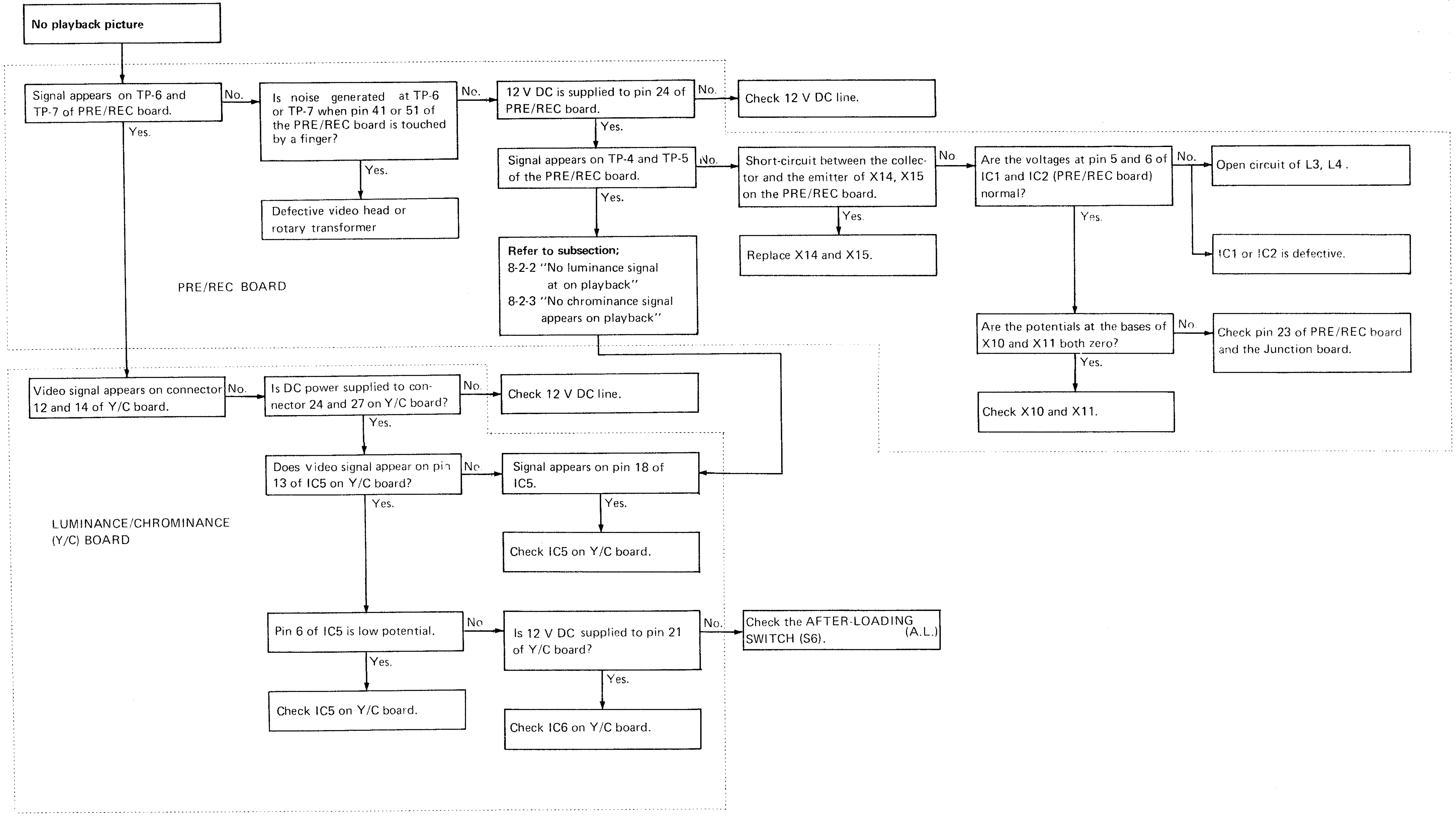
*In case a new fuse replaced for one which has blown and it blows as soon as the power switch is turned on, refer to the articles "Fuse (F1) blows readily" and "Fuse (F2) blows readily".


efect of power transistor X1 or X2.
efect of D3 of the Regulator board.
efect of transistor X1 or X2 of the Regulator board.
ault in the contact point of the relay (RY1-1)
he primary circuit of the power transformer is short-circuited.
he secondary coil of the power transformer is short-circuited.
1 of the Regulator board is short-circuited.
4 is short-circuited.
eater coil is short-cicuited.
efective power transistor X1 or X2.
he collector of the power transistor touches the chassis.
8 V power supply line is grounded.
2 V power supply line is grounded.
4 of the Regulator board is short-circuited.
12 of the Regulator board is short-circuited.
ault in the circuit of +9 V DC of the Timer.
ault in the circuit of 7 V AC of the Timer.
Fault in the power cord.
Fuse has blown. (F3)
AC 15V and 30V is supplied to secondary coil of the power transformer.
No.
AC input line is open-circuit.
Fault in the power transformer.
Yes.
Does the relay (RY1) function?
No.
Fuse (F1) has blown.※
D1 of the Regulator board is open.
Defective Relay-1 (RY1).
Yes.
5 V appears on Pin 31 of the Regulator board.
No.
Fuse (F2) has blown.※
D4 of the Regulator board is open.
R13 of the Regulator board is open.
Yes.
5 V is supplied to pin 4 of the Power switch board.
No.
5 V supplying line is cut off.
Yes.
Check the Power switch board.

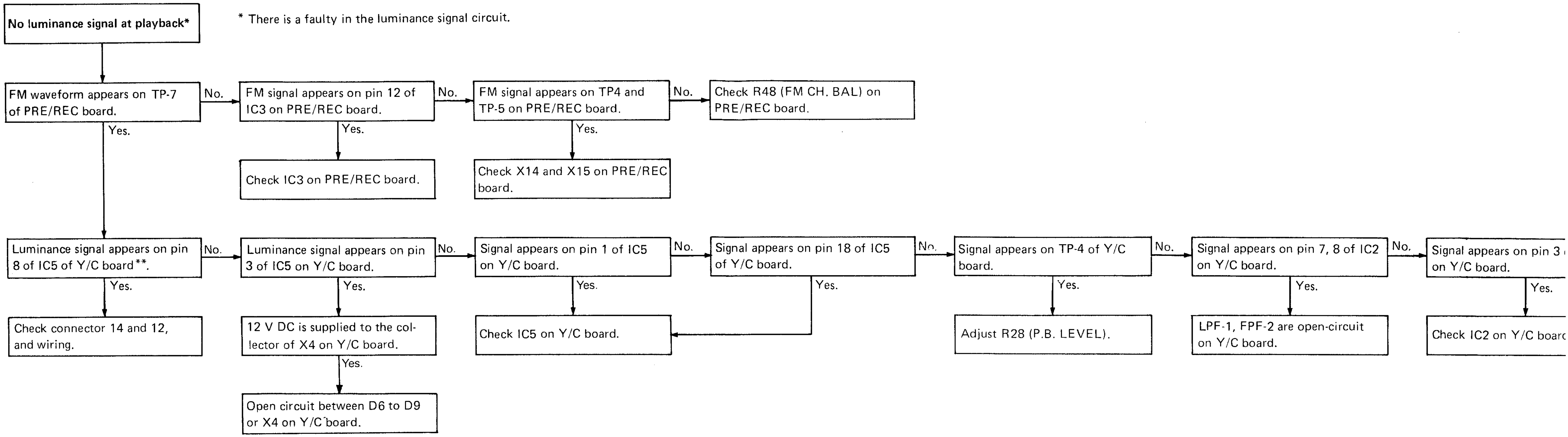
*In case a new fuse replaced for one which has blown and it blows as soon as the power switch is turned on, refer to the articles "Fuse (F1) blows readily" and "Fuse (F2) blows readily".

8-2 VIDEO SIGNAL PLAYBACK SYSTEM

8-2-1 Playback with alignment tape

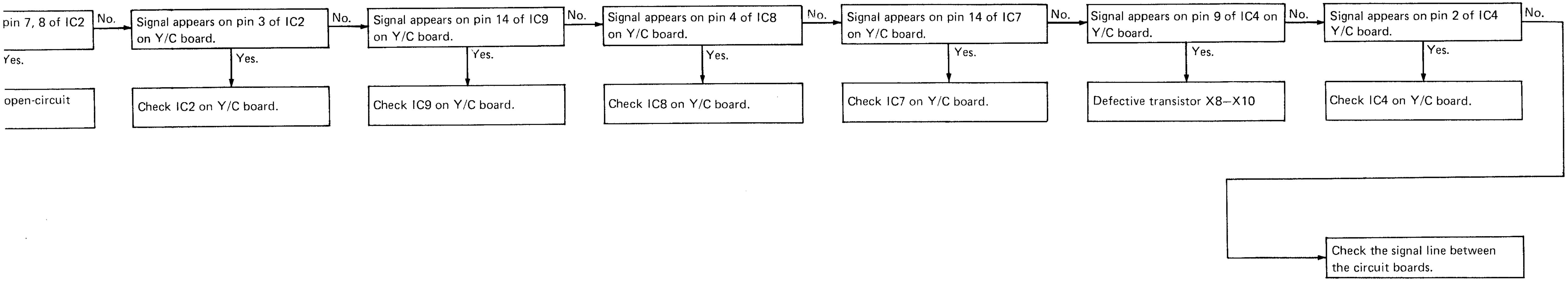

No playback picture
Signal appears on TP-6 and TP-7 of PRE/REC board.
No.
Yes.
Is noise generated at TP-6 or TP-7 when pin 41 or 51 of the PRE/REC board is touched by a finger?
No.
Yes.
Defective video head or rotary transformer
12 V DC is supplied to pin 24 of PRE/REC board.
No.
Check 12 V DC line.
Yes.
Signal appears on TP-4 and TP-5 of the PRE/REC board.
No.
Short-circuit between the collector and the emitter of X14, X15 on the PRE/REC board.
Yes.
Replace X14 and X15.
No
Are the voltages at pin 5 and 6 of IC1 and IC2 (PRE/REC board) normal?
No.
Open circuit of L3, L4.
IC1 or IC2 is defective.
Yes.
Are the potentials at the bases of X10 and X11 both zero?
No
Check pin 23 of PRE/REC board and the Junction board.
Yes.
Check X10 and X11.
Yes.
Refer to subsection;
8-2-2 "No luminance signal at on playback"
8-2-3 "No chrominance signal appears on playback"
PRE/REC BOARD
Video signal appears on connector 12 and 14 of Y/C board.
No.
Is DC power supplied to connector 24 and 27 on Y/C board?
No.
Check 12 V DC line.
Yes.
Does video signal appear on pin 13 of IC5 on Y/C board?
No.
Signal appears on pin 18 of IC5.
Yes.
Check IC5 on Y/C board.
Yes.
LUMINANCE/CHROMINANCE (Y/C) BOARD
Pin 6 of IC5 is low potential.
No
Is 12 V DC supplied to pin 21 of Y/C board?
No.
Check the AFTER-LOADING SWITCH (S6). (A.L.)
Yes.
Check IC6 on Y/C board.
Yes.
Check IC5 on Y/C board.

8-2-2 No luminance signal at playback

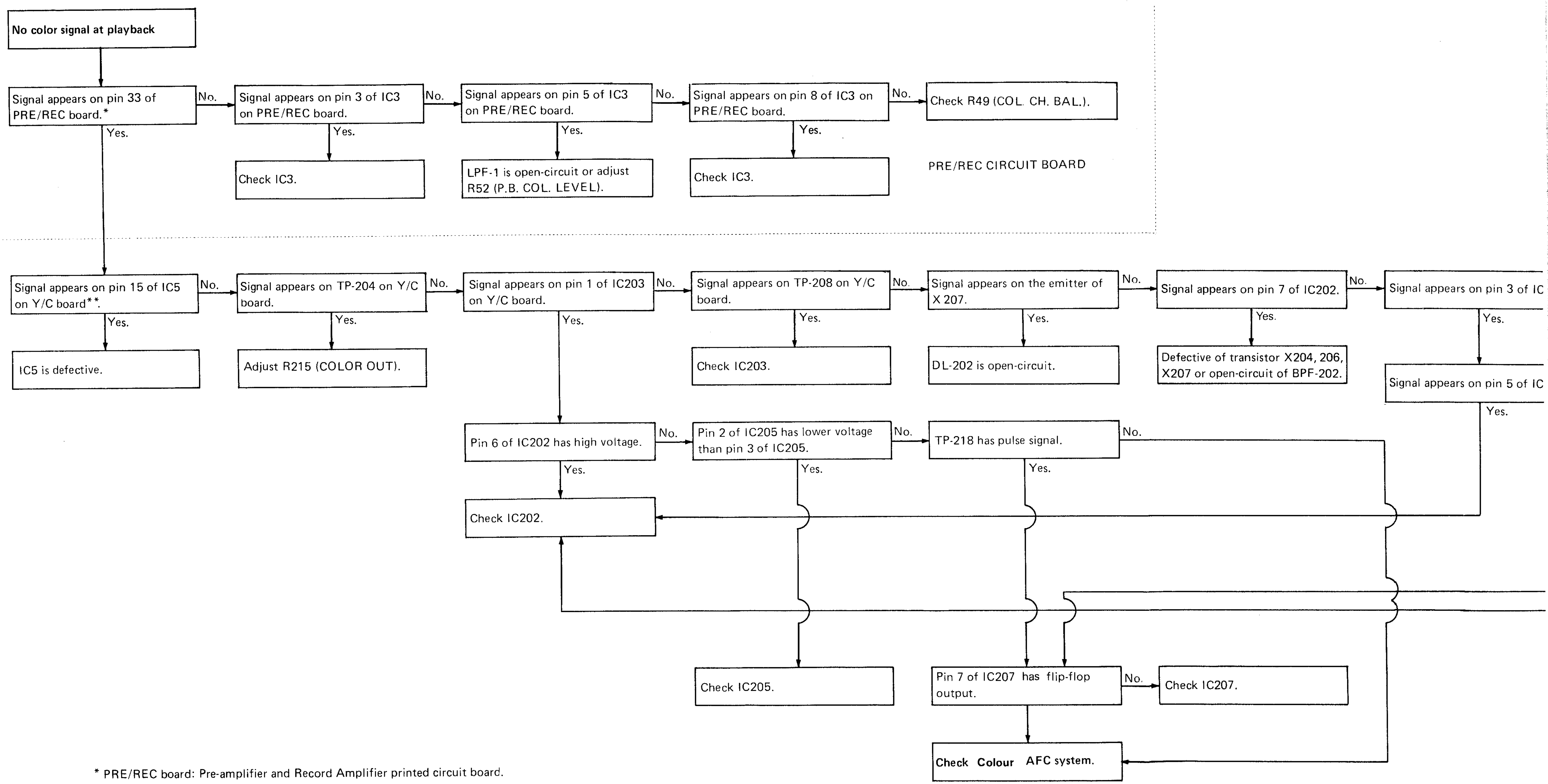

No luminance signal at playback*
FM waveform appears on TP-7 of PRE/REC board.
No.
FM signal appears on pin 12 of IC3 on PRE/REC board.
No.
FM signal appears on TP4 and TP-5 on PRE/REC board.
No.
Check R48 (FM CH. BAL) on PRE/REC board.
Yes.
Check IC3 on PRE/REC board.
Yes.
Check X14 and X15 on PRE/REC board.
Yes.
Luminance signal appears on pin 8 of IC5 of Y/C board**.
No.
Luminance signal appears on pin 3 of IC5 on Y/C board.
No.
Signal appears on pin 1 of IC5 on Y/C board.
No.
Signal appears on pin 18 of IC5 of Y/C board.
No.
Signal appears on TP-4 of Y/C board.
No.
Signal appears on pin 7, 8 of IC2 on Y/C board.
No.
Signal appears on pin 3
on Y/C board.
Yes.
Check connector 14 and 12, and wiring.
Yes.
12 V DC is supplied to the collector of X4 on Y/C board.
Yes.
Open circuit between D6 to D9 or X4 on Y/C board.
Yes.
Check IC5 on Y/C board.
Yes.
Yes.
Adjust R28 (P.B. LEVEL).
Yes.
LPF-1, FPF-2 are open-circuit on Y/C board.
Yes.
Check IC2 on Y/C boar

* There is a faulty in the luminance signal circuit.

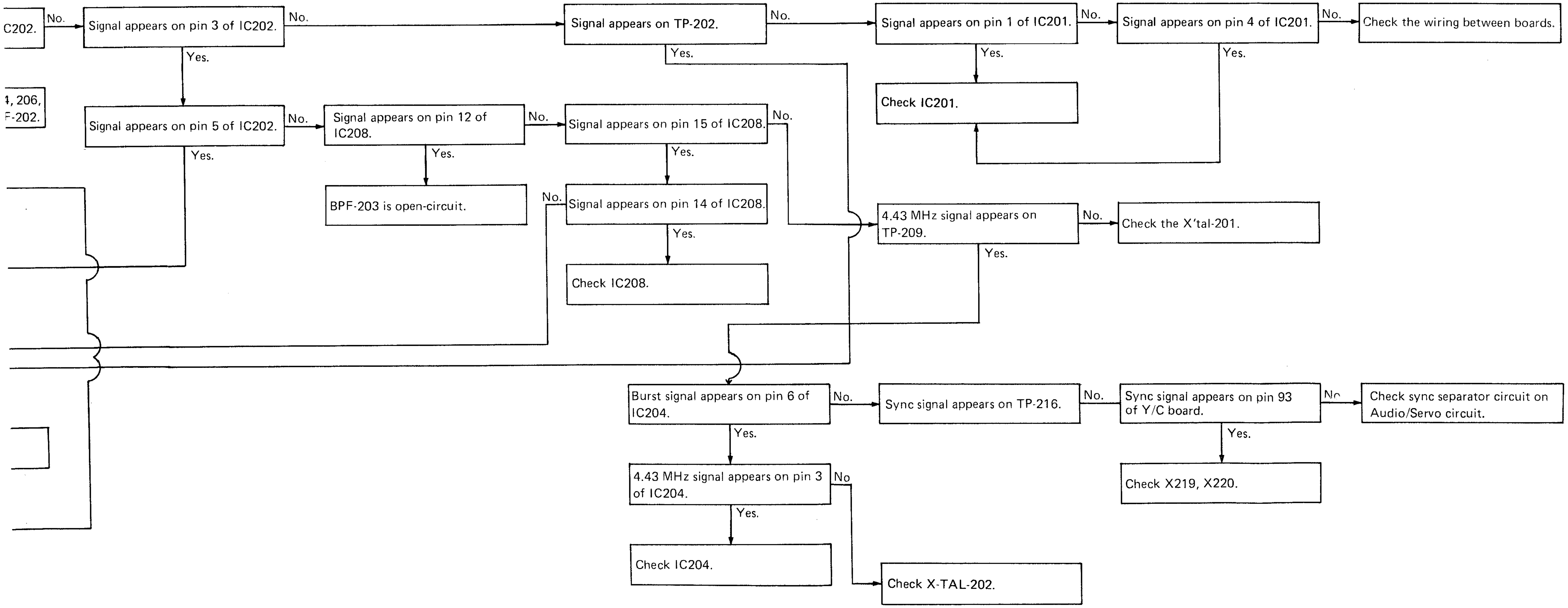
** Y/C board: Luminance/Chrominance board.


pin 7, 8 of IC2
No.
Yes.
open-circuit
Signal appears on pin 3 of IC2 on Y/C board.
No.
Yes.
Check IC2 on Y/C board.
Signal appears on pin 14 of IC9 on Y/C board.
No.
Yes.
Check IC9 on Y/C board.
Signal appears on pin 4 of IC8 on Y/C board.
No.
Yes.
Check IC8 on Y/C board.
Signal appears on pin 14 of IC7 on Y/C board.
No.
Yes.
Check IC7 on Y/C board.
Signal appears on pin 9 of IC4 on Y/C board.
No.
Yes.
Defective transistor X8–X10
Signal appears on pin 2 of IC4 Y/C board.
No.
Yes.
Check IC4 on Y/C board.
Check the signal line between the circuit boards.

8-2-3 No color signal on playback

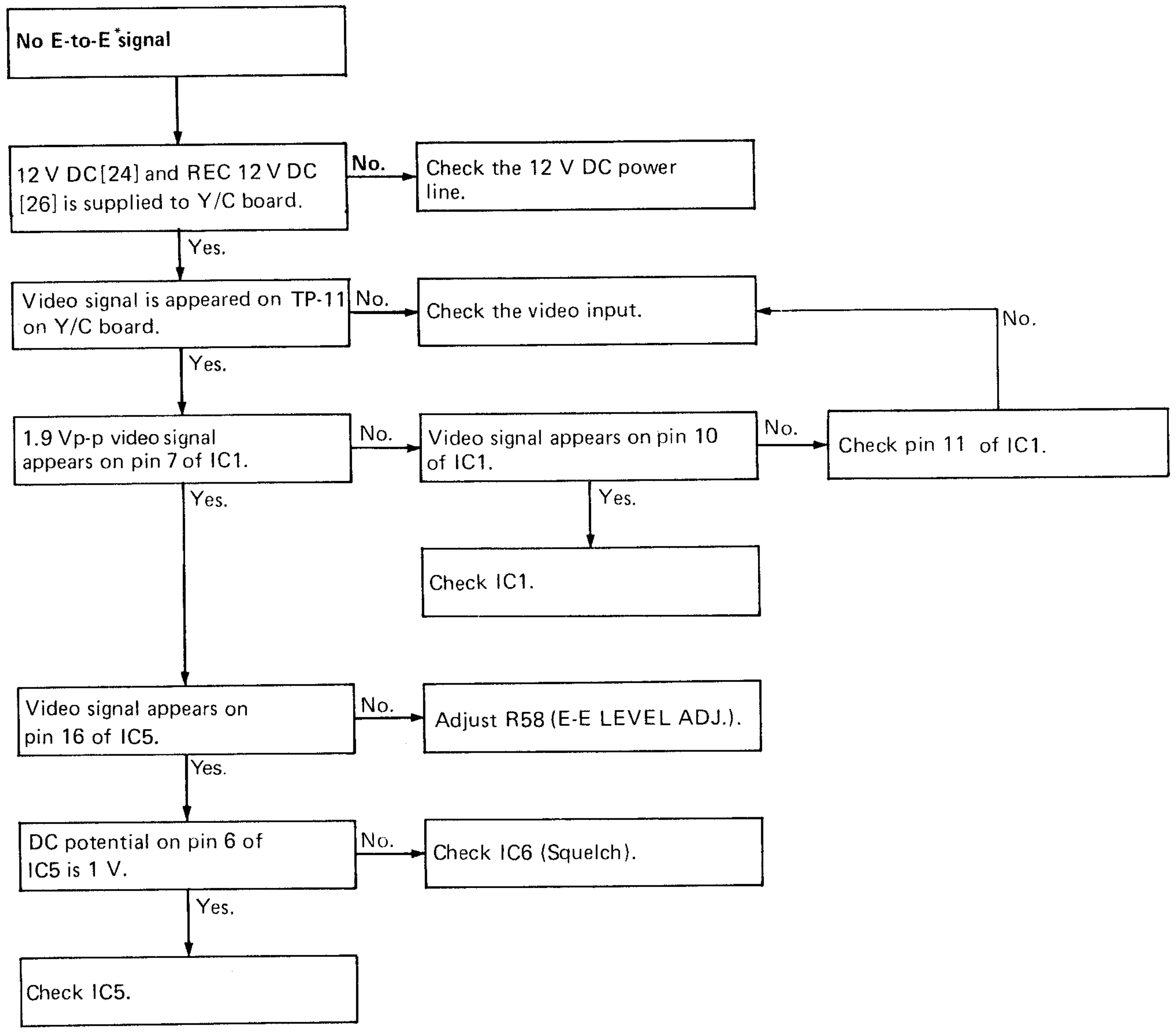

No color signal at playback
Signal appears on pin 33 of PRE/REC board.*
No.
Signal appears on pin 3 of IC3 on PRE/REC board.
No.
Signal appears on pin 5 of IC3 on PRE/REC board.
No.
Signal appears on pin 8 of IC3 on PRE/REC board.
No.
Check R49 (COL. CH. BAL.).
Yes.
Yes.
Yes.
Yes.
Check IC3.
LPF-1 is open-circuit or adjust R52 (P.B. COL. LEVEL).
Check IC3.
PRE/REC CIRCUIT BOARD
Signal appears on pin 15 of IC5 on Y/C board**.
No.
Signal appears on TP-204 on Y/C board.
No.
Signal appears on pin 1 of IC203 on Y/C board.
No.
Signal appears on TP-208 on Y/C board.
No.
Signal appears on the emitter of X 207.
No.
Signal appears on pin 7 of IC202.
No.
Signal appears on pin 3 of IC
Yes.
Yes.
Yes.
Yes.
Yes.
Yes.
Yes.
IC5 is defective.
Adjust R215 (COLOR OUT).
Check IC203.
DL-202 is open-circuit.
Defective of transistor X204, 206, X207 or open-circuit of BPF-202.
Signal appears on pin 5 of IC
Yes.
Pin 6 of IC202 has high voltage.
No.
Pin 2 of IC205 has lower voltage than pin 3 of IC205.
No.
TP-218 has pulse signal.
No.
Yes.
Yes.
Yes.
Check IC202.
Check IC205.
Pin 7 of IC207 has flip-flop output.
No.
Check IC207.
Check Colour AFC system.

* PRE/REC board: Pre-amplifier and Record Amplifier printed circuit board.
** Y/C board: Luminance/Chrominance board.


C202.
No.
Signal appears on pin 3 of IC202.
No.
Yes.
Signal appears on TP-202.
No.
Yes.
Signal appears on pin 1 of IC201.
No.
Yes.
Signal appears on pin 4 of IC201.
No.
Yes.
Check the wiring between boards.
Check IC201.
4, 206,
-202.
Signal appears on pin 5 of IC202.
No.
Yes.
Signal appears on pin 12 of IC208.
No.
Yes.
BPF-203 is open-circuit.
Signal appears on pin 15 of IC208.
No.
Yes.
No.
Signal appears on pin 14 of IC208.
Yes.
Check IC208.
4.43 MHz signal appears on TP-209.
No.
Yes.
Check the X'tal-201.
Burst signal appears on pin 6 of IC204.
No.
Yes.
Sync signal appears on TP-216.
No.
Sync signal appears on pin 93 of Y/C board.
No
Yes.
Check sync separator circuit on Audio/Servo circuit.
Check X219, X220.
4.43 MHz signal appears on pin 3 of IC204.
No
Yes.
Check IC204.
Check X-TAL-202.

8-3 VIDEO RECORDING SYSTEM

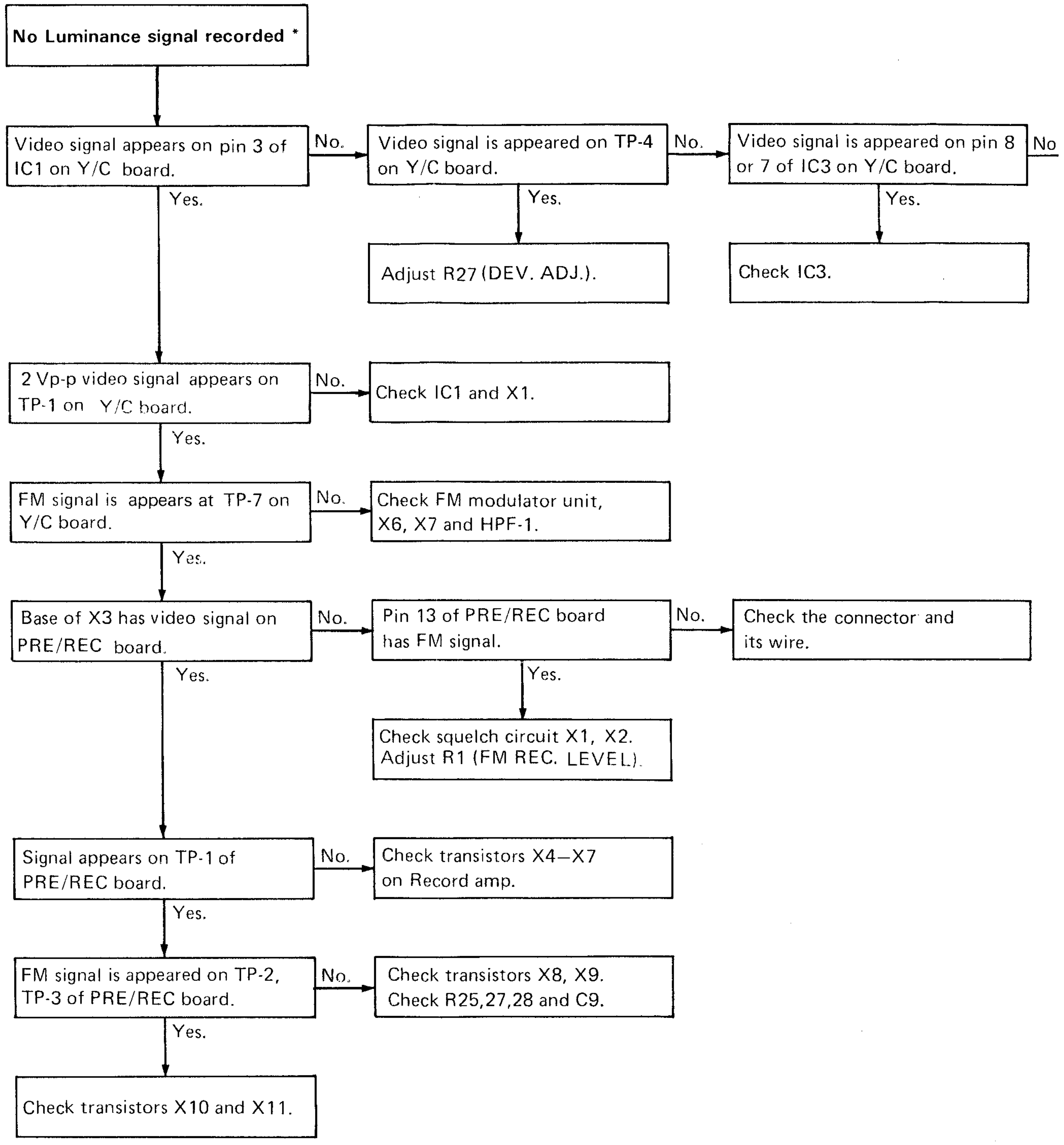
8-3-1 E-to-E signal line


No E-to-E*signal
12 V DC[24] and REC 12 V DC [26] is supplied to Y/C board.
No.
Check the 12 V DC power line.
Yes.
Video signal is appeared on TP-11 on Y/C board.
No.
Check the video input.
No.
Yes.
1.9 Vp-p video signal appears on pin 7 of IC1.
No.
Video signal appears on pin 10 of IC1.
No.
Check pin 11 of IC1.
Yes.
Check IC1.
Yes.
Video signal appears on pin 16 of IC5.
No.
Adjust R58 (E-E LEVEL ADJ.).
Yes.
DC potential on pin 6 of IC5 is 1 V.
No.
Check IC6 (Squelch).
Yes.
Check IC5.

NOTE: Presupposing that all the circuits used in common with the playback system are normal.

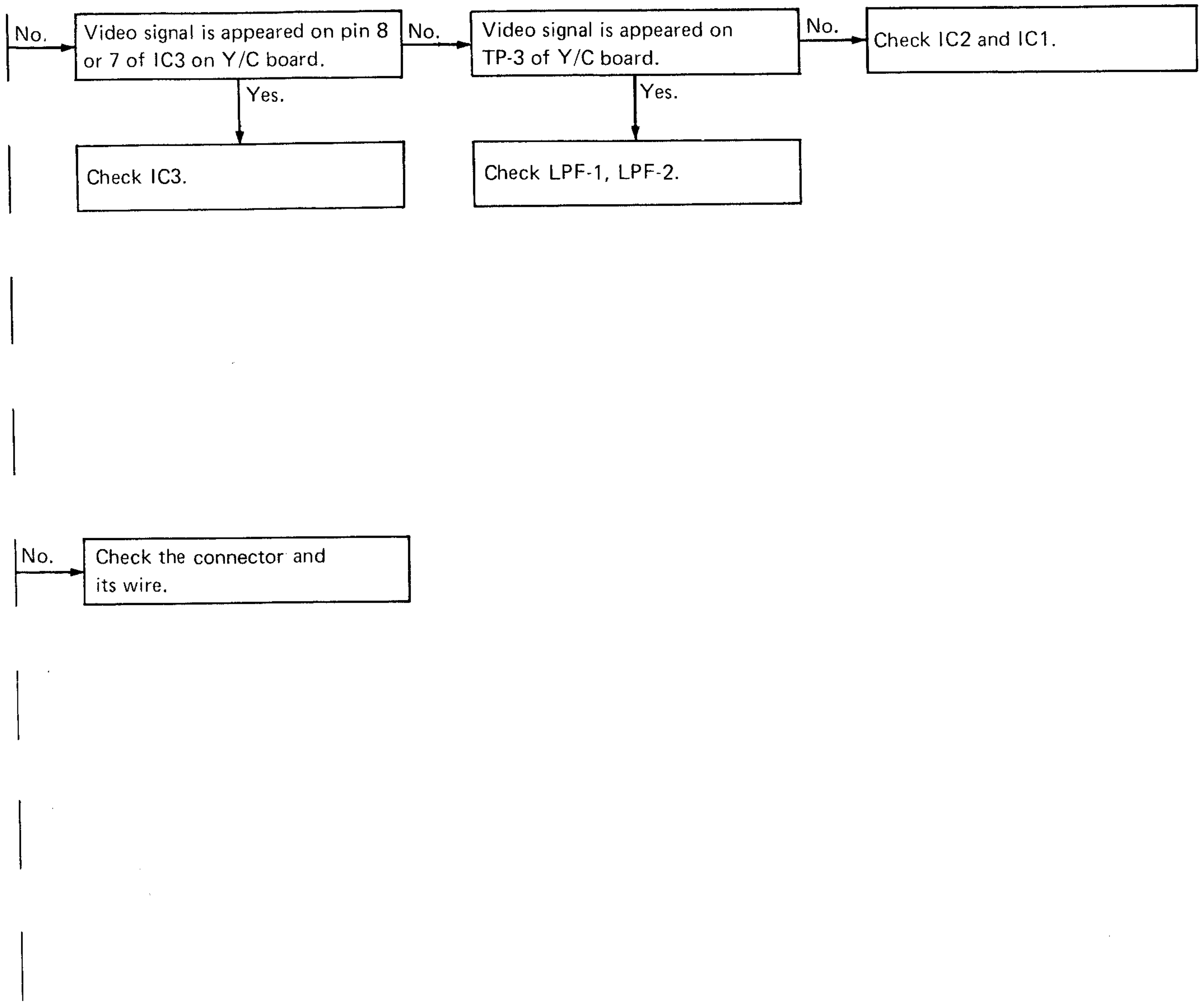
* E to E : Electronic to Electronic.

8-3-2 Luminance signal — No record

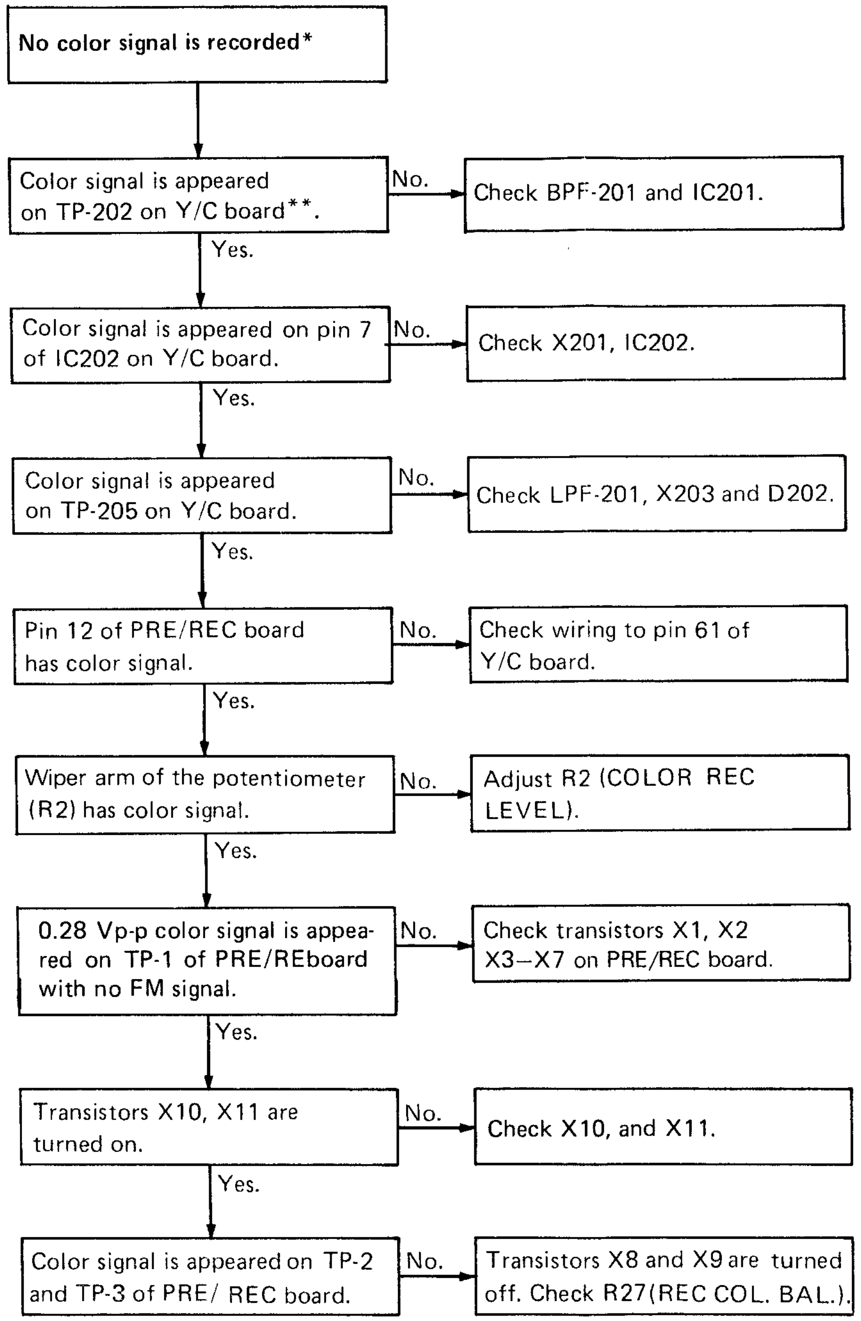

No Luminance signal recorded *
Video signal appears on pin 3 of IC1 on Y/C board.
No.
Video signal is appeared on TP-4 on Y/C board.
No.
Video signal is appeared on pin 8 or 7 of IC3 on Y/C board.
No
Yes.
Yes.
Adjust R27 (DEV. ADJ.).
Yes.
Check IC3.
2 Vp-p video signal appears on TP-1 on Y/C board.
No.
Check IC1 and X1.
Yes.
FM signal is appears at TP-7 on Y/C board.
No.
Check FM modulator unit, X6, X7 and HPF-1.
Yes.
Base of X3 has video signal on PRE/REC board.
No.
Pin 13 of PRE/REC board has FM signal.
No.
Check the connector and its wire.
Yes.
Yes.
Check squelch circuit X1, X2. Adjust R1 (FM REC. LEVEL).
Signal appears on TP-1 of PRE/REC board.
No.
Check transistors X4–X7 on Record amp.
Yes.
FM signal is appeared on TP-2, TP-3 of PRE/REC board.
No.
Check transistors X8, X9. Check R25,27,28 and C9.
Yes.
Check transistors X10 and X11.

*The following excludes the circuit of E-to-E system.

**Y/C : Luminance and color printed circuit board.


No.
Video signal is appeared on pin 8 or 7 of IC3 on Y/C board.
No.
Video signal is appeared on TP-3 of Y/C board.
No.
Check IC2 and IC1.
Yes.
Yes.
Check IC3.
Check LPF-1, LPF-2.
No.
Check the connector and its wire.

8-3-3 Color signal – No record

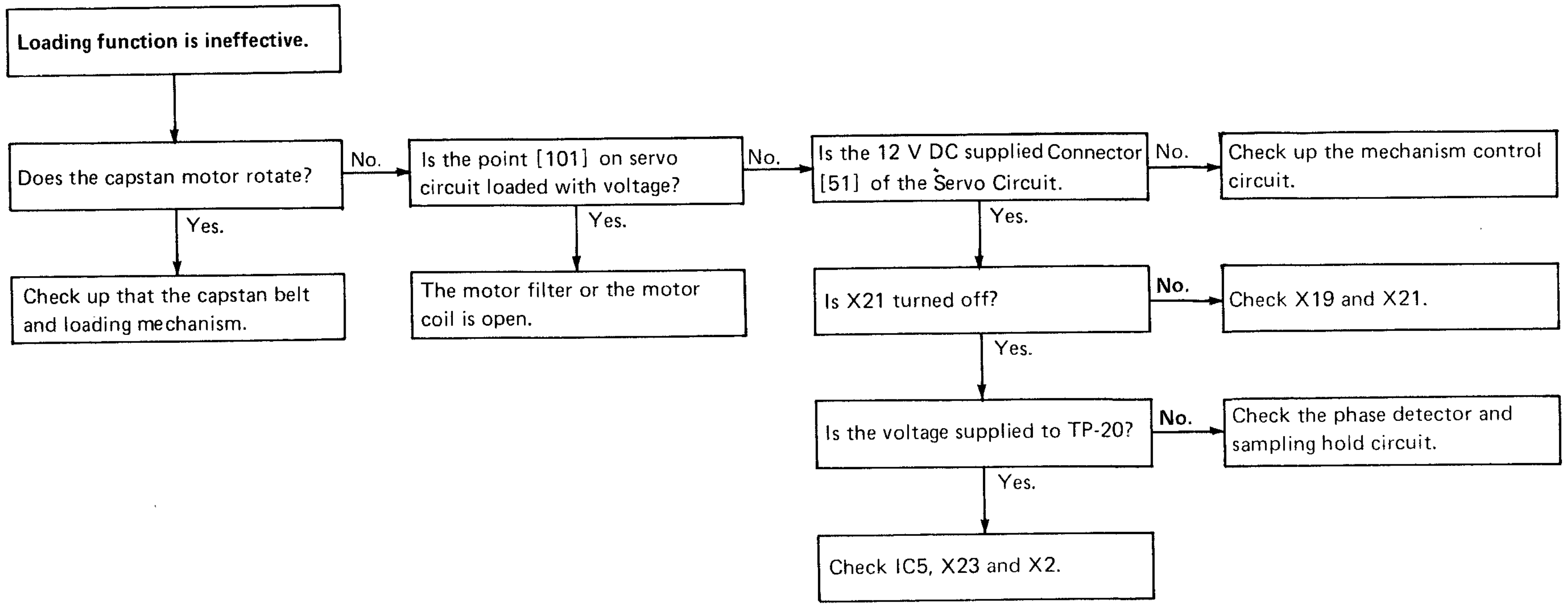

No color signal is recorded*
Color signal is appeared on TP-202 on Y/C board**.
No.
Check BPF-201 and IC201.
Yes.
Color signal is appeared on pin 7 of IC202 on Y/C board.
No.
Check X201, IC202.
Yes.
Color signal is appeared on TP-205 on Y/C board.
No.
Check LPF-201, X203 and D202.
Yes.
Pin 12 of PRE/REC board has color signal.
No.
Check wiring to pin 61 of Y/C board.
Yes.
Wiper arm of the potentiometer (R2) has color signal.
No.
Adjust R2 (COLOR REC LEVEL).
Yes.
0.28 Vp-p color signal is appeared on TP-1 of PRE/REboard with no FM signal.
No.
Check transistors X1, X2 X3–X7 on PRE/REC board.
Yes.
Transistors X10, X11 are turned on.
No.
Check X10, and X11.
Yes.
Color signal is appeared on TP-2 and TP-3 of PRE/ REC board.
No.
Transistors X8 and X9 are turned off. Check R27(REC COL. BAL.).

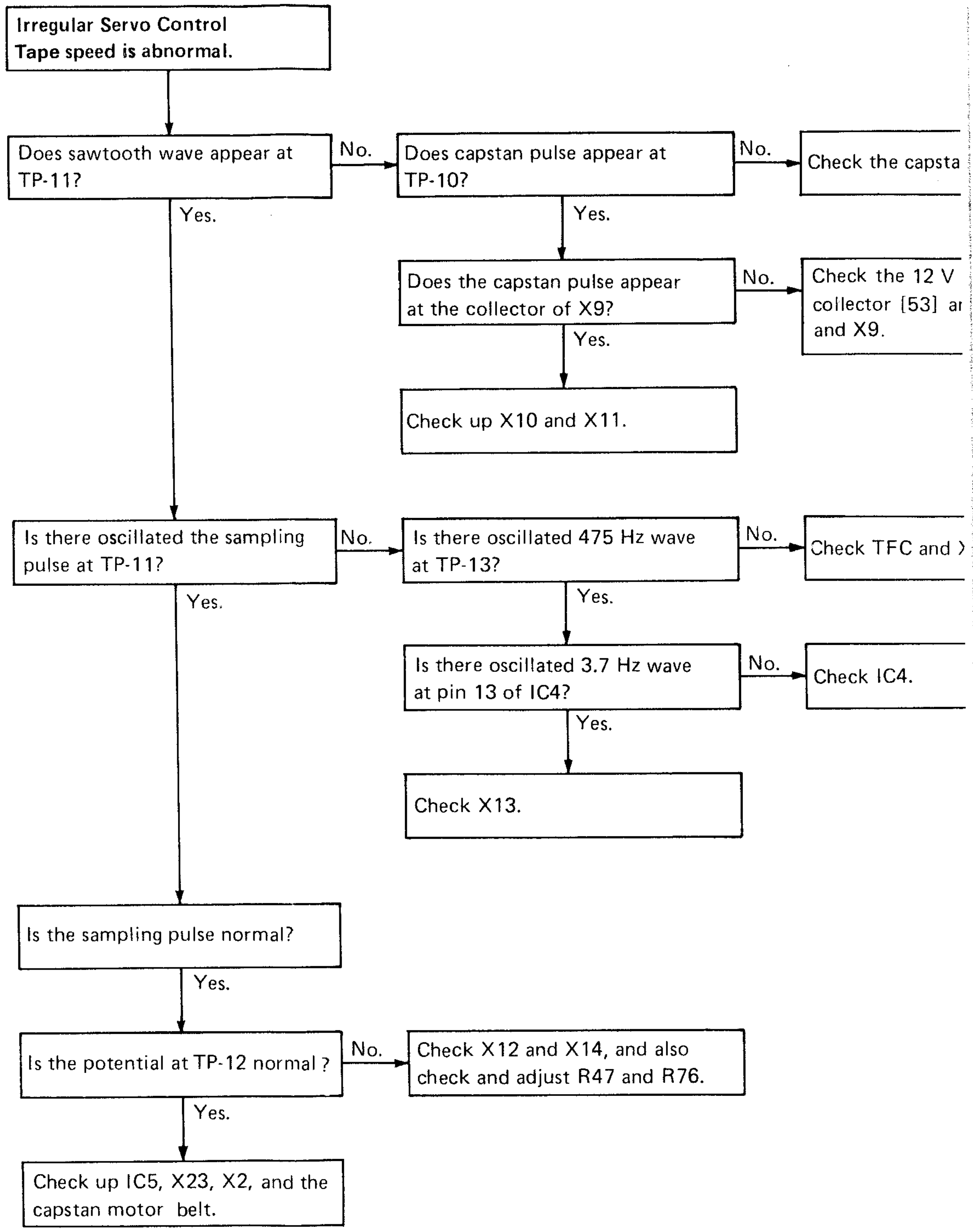
*The following excludes the E-to-E circuits.

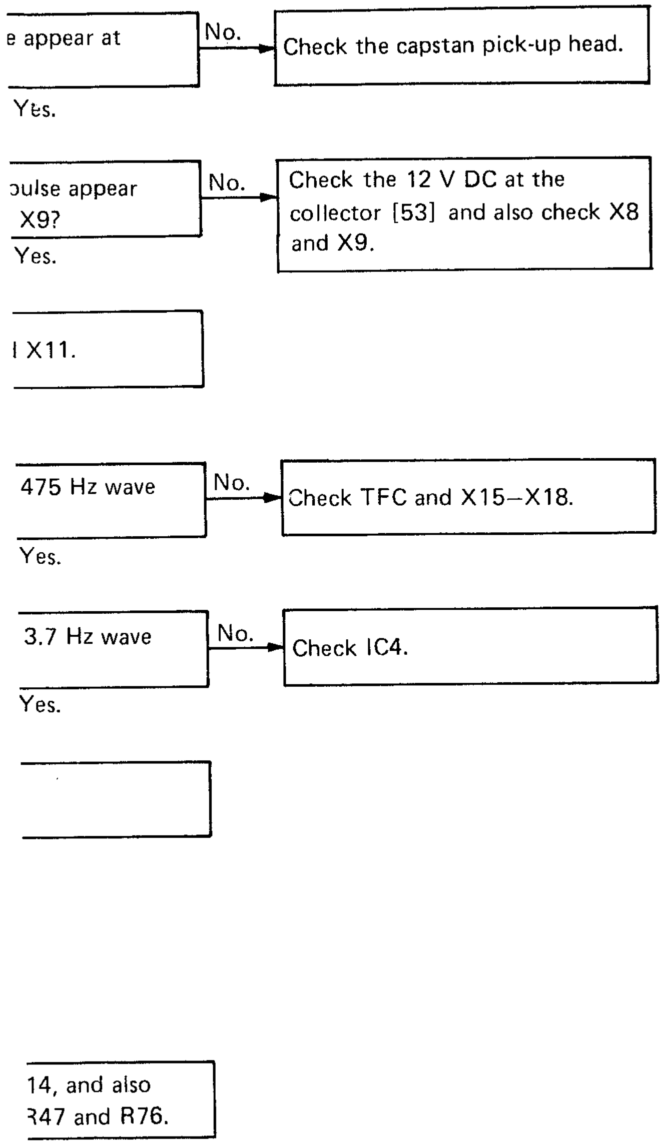
**Y/C: Luminance and color printed circuit board.

8-4 SERVO CIRCUIT

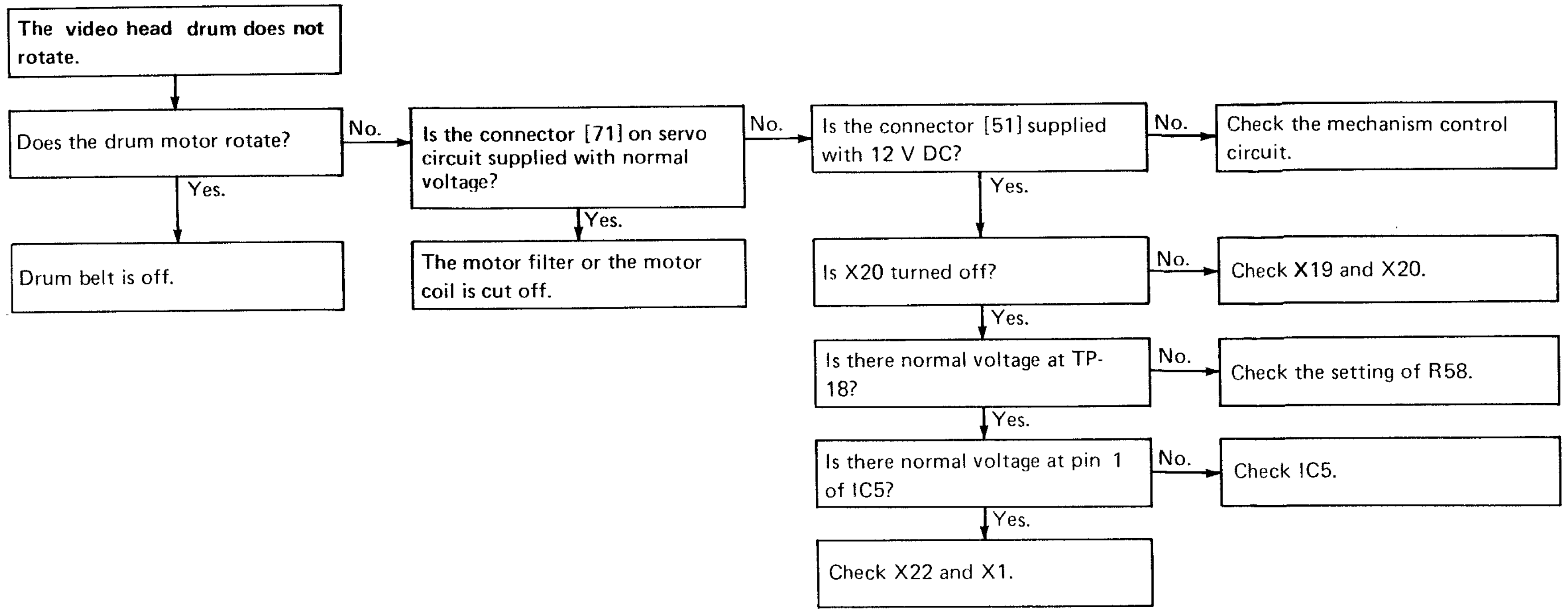
8-4-1 Capstan servo circuit

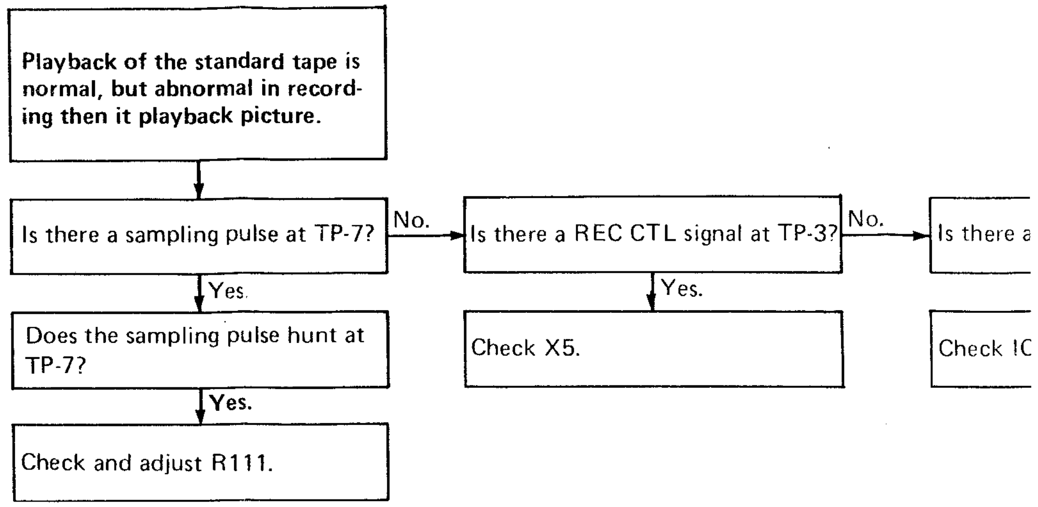

Loading function is ineffective.
Does the capstan motor rotate?
No.
Yes.
Check up that the capstan belt and loading mechanism.
Is the point [101] on servo circuit loaded with voltage?
No.
Yes.
The motor filter or the motor coil is open.
Is the 12 V DC supplied Connector [51] of the Servo Circuit.
No.
Check up the mechanism control circuit.
Yes.
Is X21 turned off?
No.
Check X19 and X21.
Yes.
Is the voltage supplied to TP-20?
No.
Check the phase detector and sampling hold circuit.
Yes.
Check IC5, X23 and X2.

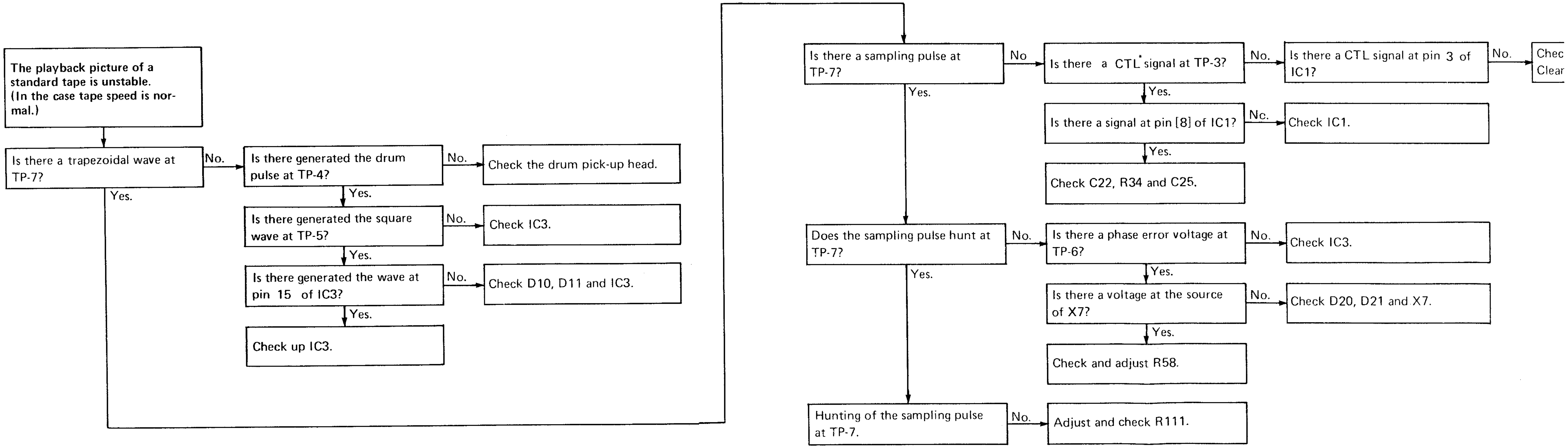

Irregular Servo Control
Tape speed is abnormal.
Does sawtooth wave appear at TP-11?
No.
Does capstan pulse appear at TP-10?
No.
Check the capsta
Yes.
Does the capstan pulse appear at the collector of X9?
No.
Check the 12 V collector [53] a
and X9.
Yes.
Check up X10 and X11.
Yes.
Is there oscillated the sampling pulse at TP-11?
No.
Is there oscillated 475 Hz wave at TP-13?
No.
Check TFC and
Yes.
Is there oscillated 3.7 Hz wave at pin 13 of IC4?
No.
Check IC4.
Yes.
Check X13.
Yes.
Is the sampling pulse normal?
Yes.
Is the potential at TP-12 normal ?
No.
Check X12 and X14, and also check and adjust R47 and R76.
Yes.
Check up IC5, X23, X2, and the capstan motor belt.


e appear at
No.
Check the capstan pick-up head.
Yes.
pulse appear
X9?
No.
Check the 12 V DC at the collector [53] and also check X8 and X9.
Yes.
X11.
475 Hz wave
No.
Check TFC and X15–X18.
Yes.
3.7 Hz wave
No.
Check IC4.
Yes.
14, and also
R47 and R76.

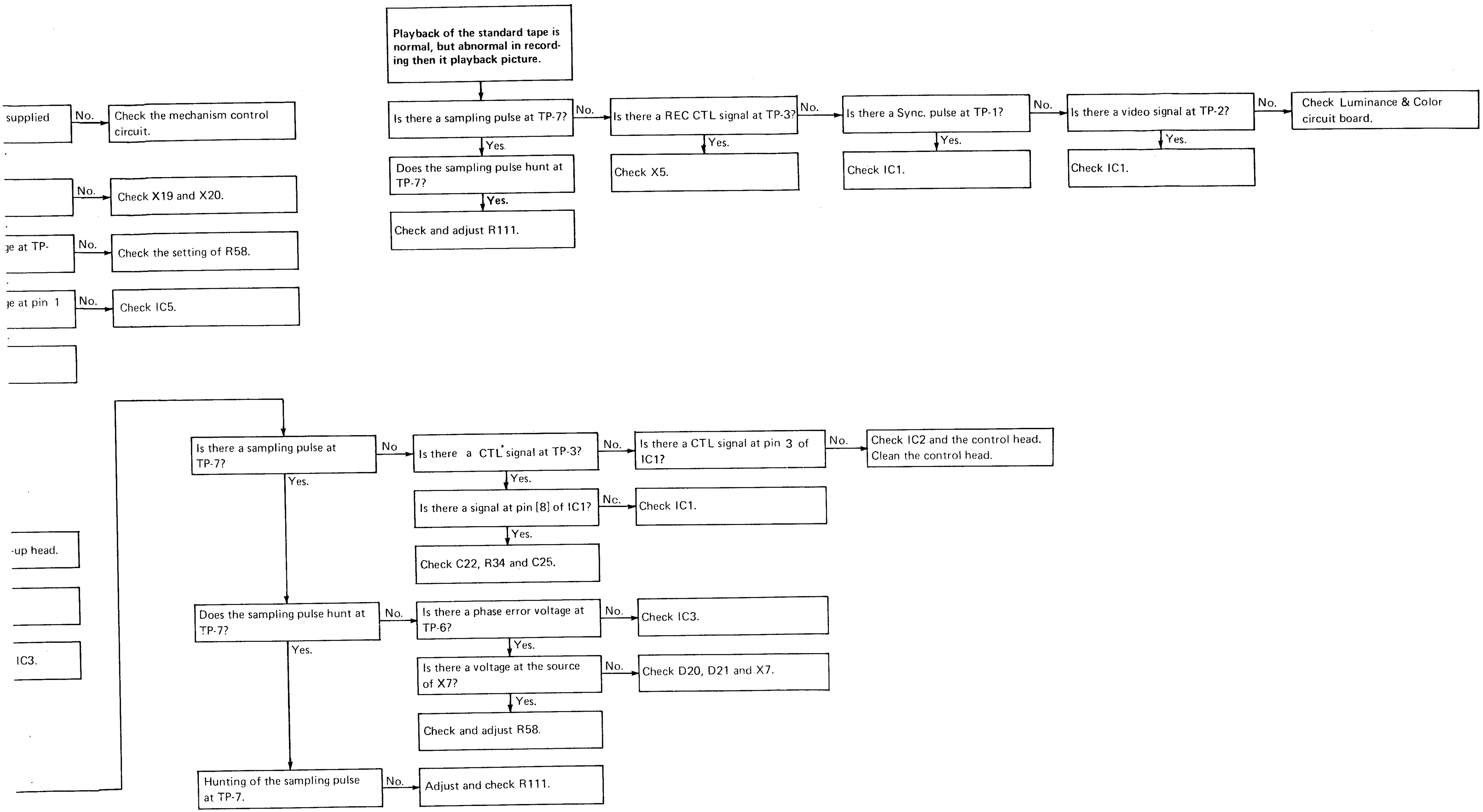
8-4-2 Drum servo circuit


The video head drum does not rotate.
Does the drum motor rotate?
No.
Yes.
Drum belt is off.
Is the connector [71] on servo circuit supplied with normal voltage?
No.
Yes.
The motor filter or the motor coil is cut off.
Is the connector [51] supplied with 12 V DC?
No.
Check the mechanism control circuit.
Yes.
Is X20 turned off?
No.
Check X19 and X20.
Yes.
Is there normal voltage at TP-18?
No.
Check the setting of R58.
Yes.
Is there normal voltage at pin 1 of IC5?
No.
Check IC5.
Yes.
Check X22 and X1.


Playback of the standard tape is normal, but abnormal in recording then it playback picture.
Is there a sampling pulse at TP-7?
No.
Is there a REC CTL signal at TP-3?
No.
Is there a
Yes.
Check X5.
Check IC
Yes.
Does the sampling pulse hunt at TP-7?
Yes.
Check and adjust R111.


The playback picture of a standard tape is unstable. (In the case tape speed is normal.)
Is there a trapezoidal wave at TP-7?
No.
Is there generated the drum pulse at TP-4?
No.
Check the drum pick-up head.
Yes.
Is there generated the square wave at TP-5?
No.
Check IC3.
Yes.
Is there generated the wave at pin 15 of IC3?
No.
Check D10, D11 and IC3.
Yes.
Check up IC3.
Yes.
Is there a sampling pulse at TP-7?
No
Is there a CTL* signal at TP-3?
No.
Is there a CTL signal at pin 3 of IC1?
No.
Chec
Clear
Yes.
Is there a signal at pin [8] of IC1?
No.
Check IC1.
Yes.
Check C22, R34 and C25.
Yes.
Does the sampling pulse hunt at TP-7?
No.
Is there a phase error voltage at TP-6?
No.
Check IC3.
Yes.
Is there a voltage at the source of X7?
No.
Check D20, D21 and X7.
Yes.
Check and adjust R58.
Yes.
Hunting of the sampling pulse at TP-7.
No.
Adjust and check R111.

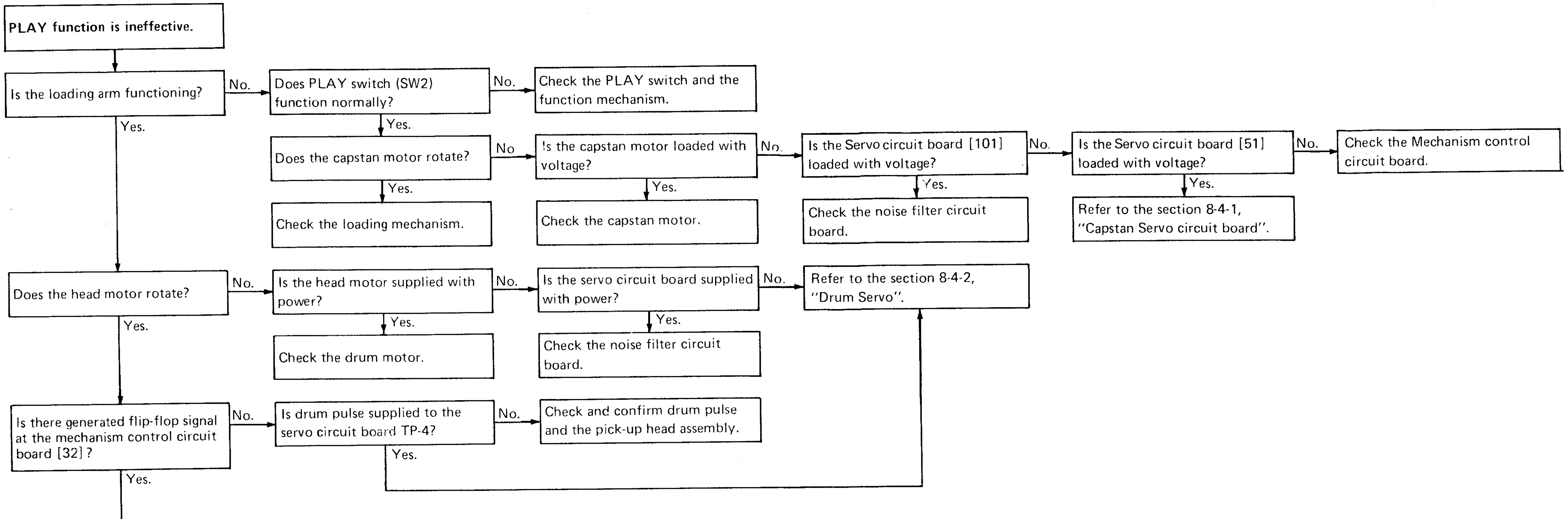
* CTL : Control

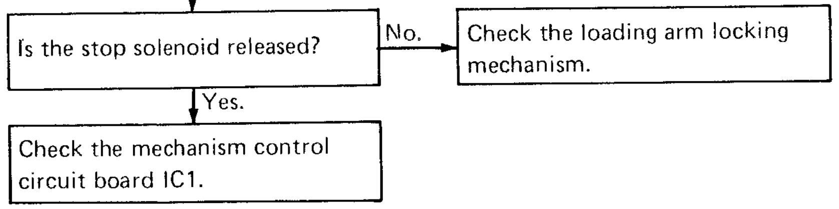

Playback of the standard tape is normal, but abnormal in recording then it playback picture.
supplied
No.
Check the mechanism control circuit.
No.
Check X19 and X20.
ge at TP-
No.
Check the setting of R58.
ge at pin 1
No.
Check IC5.
Is there a sampling pulse at TP-7?
Yes.
Does the sampling pulse hunt at TP-7?
Yes.
Check and adjust R111.
No.
Is there a REC CTL signal at TP-3?
Yes.
Check X5.
No.
Is there a Sync. pulse at TP-1?
Yes.
Check IC1.
No.
Is there a video signal at TP-2?
Yes.
Check IC1.
No.
Check Luminance & Color circuit board.
-up head.
IC3.
Is there a sampling pulse at TP-7?
No
Is there a CTL* signal at TP-3?
No.
Is there a CTL signal at pin 3 of IC1?
No.
Check IC2 and the control head. Clean the control head.
Yes.
Yes.
Is there a signal at pin [8] of IC1?
No.
Check IC1.
Yes.
Check C22, R34 and C25.
Does the sampling pulse hunt at TP-7?
No.
Is there a phase error voltage at TP-6?
No.
Check IC3.
Yes.
Yes.
Is there a voltage at the source of X7?
No.
Check D20, D21 and X7.
Yes.
Check and adjust R58.
Hunting of the sampling pulse at TP-7.
No.
Adjust and check R111.

* CTL : Control

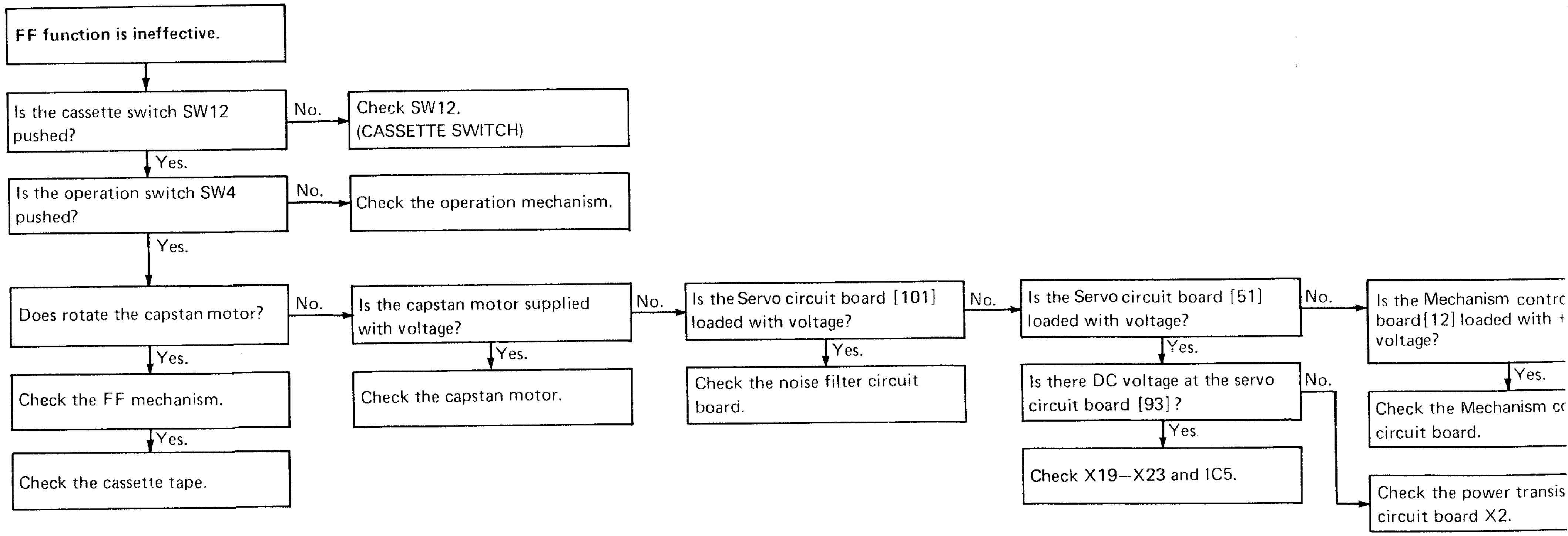
8-5 TROUBLESHOOTING OF MECHANISM AND MECHANISM CONTROLS

8-5-1 PLAY function is ineffective

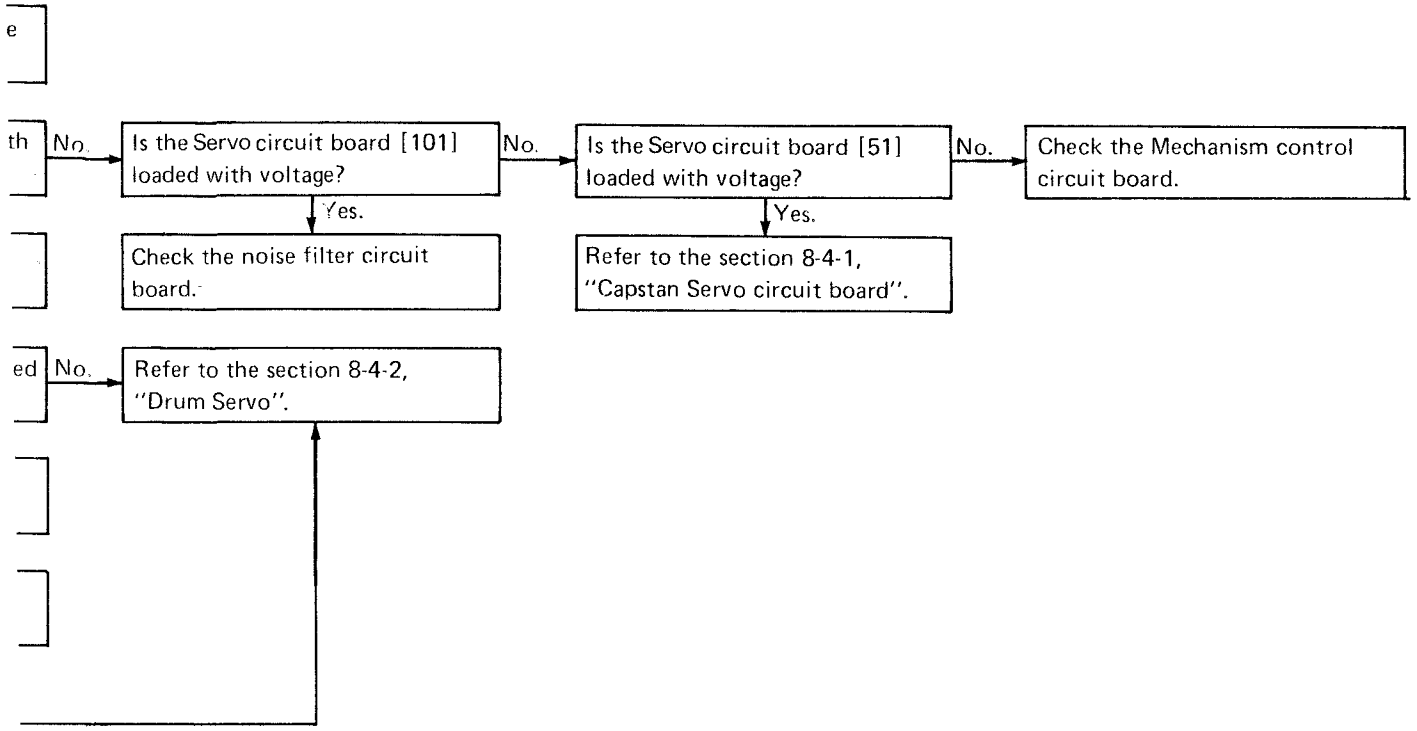

PLAY function is ineffective.
Is the loading arm functioning?
No.
Does PLAY switch (SW2) function normally?
No.
Check the PLAY switch and the function mechanism.
Yes.
Does the capstan motor rotate?
No
Is the capstan motor loaded with voltage?
No.
Is the Servo circuit board [101] loaded with voltage?
No.
Is the Servo circuit board [51] loaded with voltage?
No.
Check the Mechanism control circuit board.
Yes.
Check the loading mechanism.
Yes.
Check the capstan motor.
Yes.
Check the noise filter circuit board.
Yes.
Refer to the section 8-4-1, "Capstan Servo circuit board".
Yes.
Does the head motor rotate?
No.
Is the head motor supplied with power?
No.
Is the servo circuit board supplied with power?
No.
Refer to the section 8-4-2, "Drum Servo".
Yes.
Check the drum motor.
Yes.
Check the noise filter circuit board.
Yes.
Is there generated flip-flop signal at the mechanism control circuit board [32]?
No.
Is drum pulse supplied to the servo circuit board TP-4?
No.
Check and confirm drum pulse and the pick-up head assembly.
Yes.
Yes.


Is the stop solenoid released?
No.
Check the loading arm locking mechanism.
Yes.
Check the mechanism control circuit board IC1.

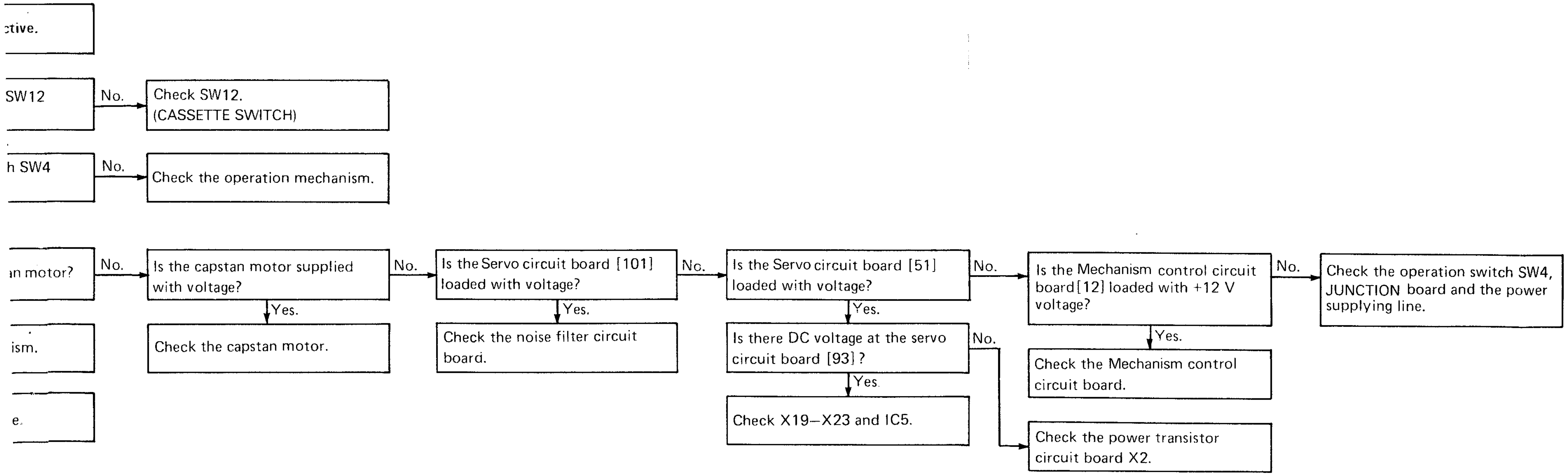
8-5-2 F.F. function is ineffective


FF function is ineffective.
Is the cassette switch SW12 pushed?
No.
Check SW12. (CASSETTE SWITCH)
Yes.
Is the operation switch SW4 pushed?
No.
Check the operation mechanism.
Yes.
Does rotate the capstan motor?
No.
Is the capstan motor supplied with voltage?
No.
Is the Servo circuit board [101] loaded with voltage?
No.
Is the Servo circuit board [51] loaded with voltage?
No.
Is the Mechanism contr board [12] loaded with + voltage?
Yes.
Check the FF mechanism.
Yes.
Check the capstan motor.
Yes.
Check the noise filter circuit board.
Yes.
Is there DC voltage at the servo circuit board [93]?
No.
Yes.
Check the Mechanism c circuit board.
Yes.
Check the cassette tape.
Yes.
Check X19–X23 and IC5.
Check the power transis circuit board X2.

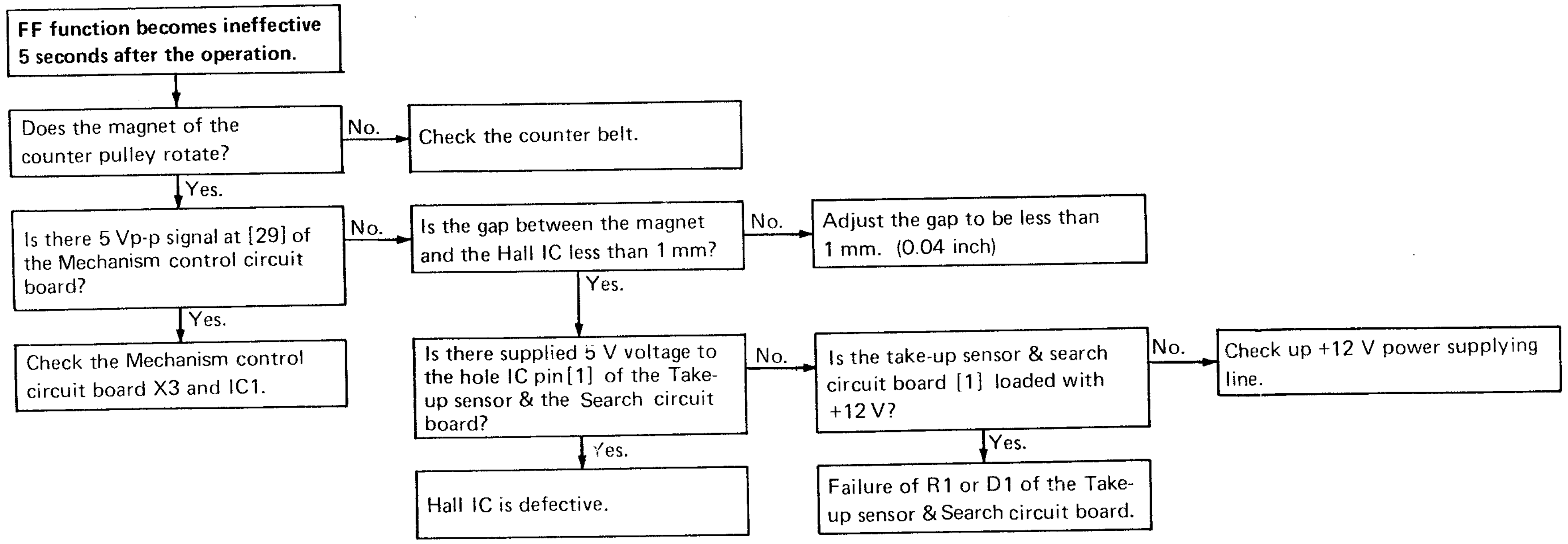
NOTE: All the following procedures for the articles 1 through 5 should be done without any cassette tape loaded. Cover the photo transistors (END SENSOR, START SENSOR) with black vinyl tape beforehand.


e
th
No.
Is the Servo circuit board [101] loaded with voltage?
No.
Is the Servo circuit board [51] loaded with voltage?
No.
Check the Mechanism control circuit board.
Yes.
Check the noise filter circuit board.
Yes.
Refer to the section 8-4-1, "Capstan Servo circuit board".
ed
No.
Refer to the section 8-4-2, "Drum Servo".

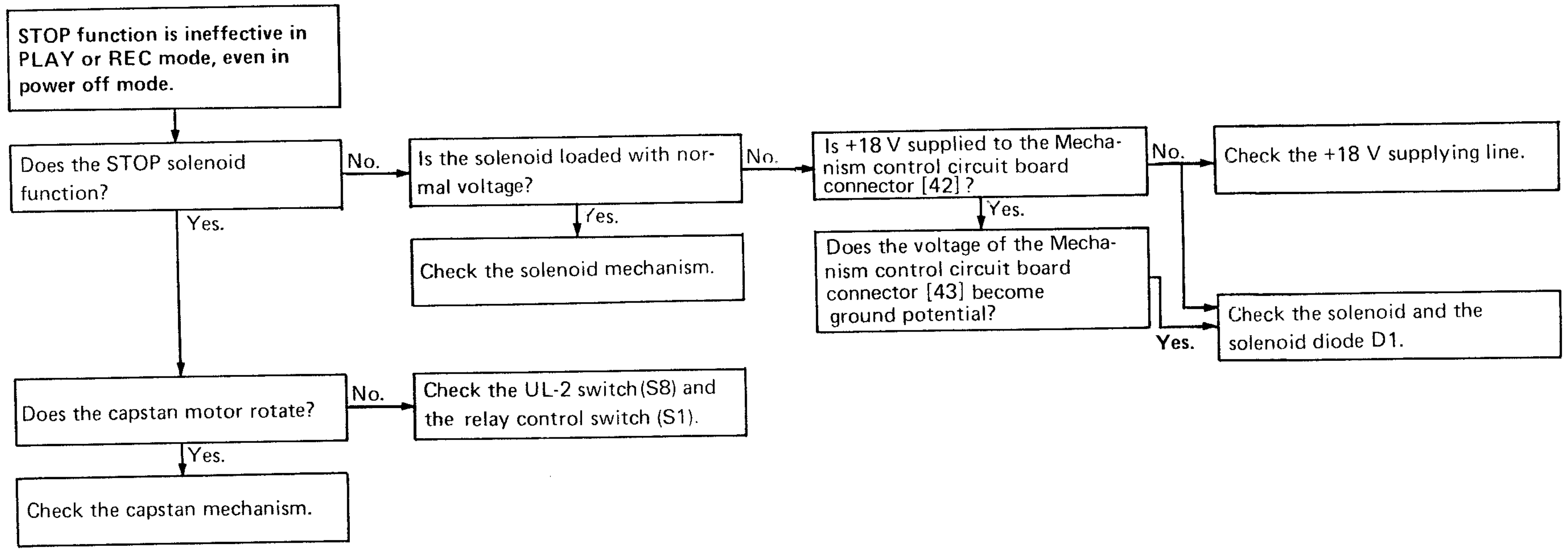
; ineffective

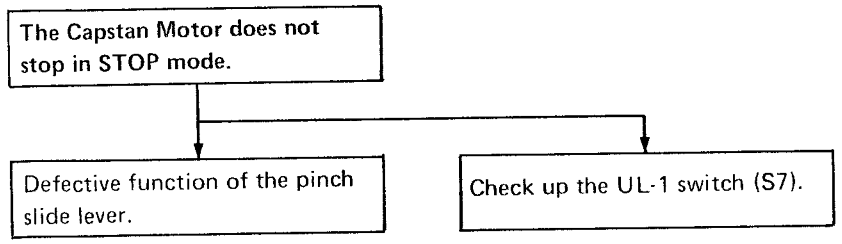

:tive.
SW12
No.
Check SW12. (CASSETTE SWITCH)
h SW4
No.
Check the operation mechanism.
ın motor?
No.
Is the capstan motor supplied with voltage?
No.
Is the Servo circuit board [101] loaded with voltage?
No.
Is the Servo circuit board [51] loaded with voltage?
No.
Is the Mechanism control circuit board [12] loaded with +12 V voltage?
No.
Check the operation switch SW4, JUNCTION board and the power supplying line.
Yes.
Check the capstan motor.
Yes.
Check the noise filter circuit board.
Yes.
Is there DC voltage at the servo circuit board [93]?
No.
Yes.
Check X19–X23 and IC5.
Yes.
Check the Mechanism control circuit board.
Check the power transistor circuit board X2.
ism.
e.

8-5-3 F.F. function becomes ineffective

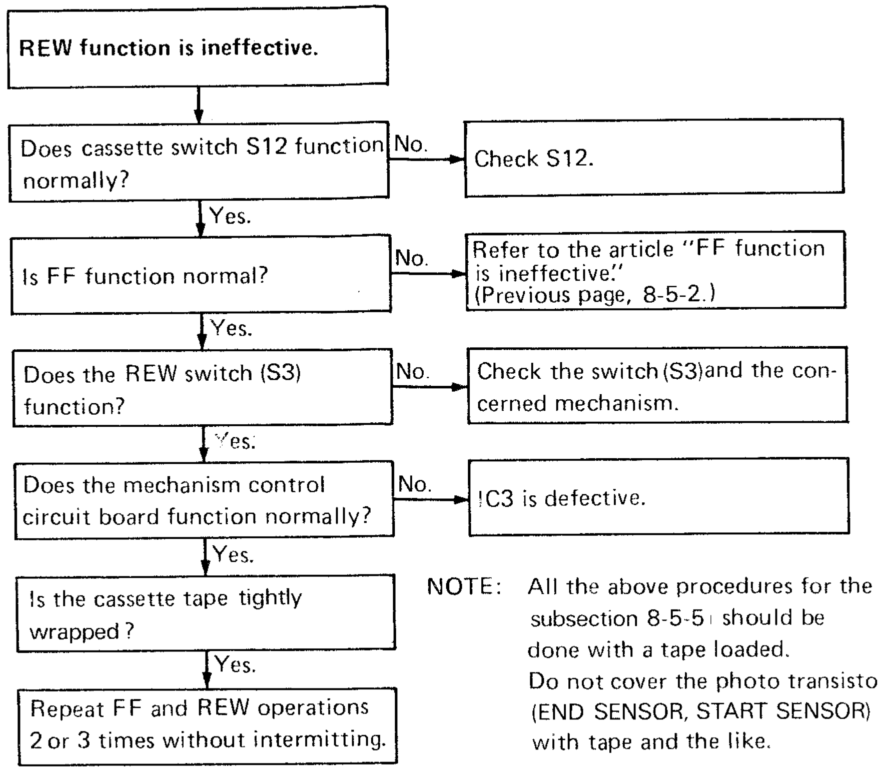

FF function becomes ineffective 5 seconds after the operation.
Does the magnet of the counter pulley rotate?
No.
Check the counter belt.
Yes.
Is there 5 Vp-p signal at [29] of the Mechanism control circuit board?
No.
Is the gap between the magnet and the Hall IC less than 1 mm?
No.
Adjust the gap to be less than 1 mm. (0.04 inch)
Yes.
Check the Mechanism control circuit board X3 and IC1.
Yes.
Is there supplied 5 V voltage to the hole IC pin[1] of the Take-up sensor & the Search circuit board?
No.
Is the take-up sensor & search circuit board [1] loaded with +12 V?
No.
Check up +12 V power supplying line.
Yes.
Hall IC is defective.
Yes.
Failure of R1 or D1 of the Take-up sensor & Search circuit board.

8-5-4 STOP function is ineffective


STOP function is ineffective in PLAY or REC mode, even in power off mode.
Does the STOP solenoid function?
No.
Is the solenoid loaded with normal voltage?
No.
Is +18 V supplied to the Mechanism control circuit board connector [42] ?
No.
Check the +18 V supplying line.
Yes.
Check the solenoid mechanism.
Yes.
Does the voltage of the Mechanism control circuit board connector [43] become ground potential?
Yes.
Check the solenoid and the solenoid diode D1.
Yes.
Does the capstan motor rotate?
No.
Check the UL-2 switch(S8) and the relay control switch (S1).
Yes.
Check the capstan mechanism.

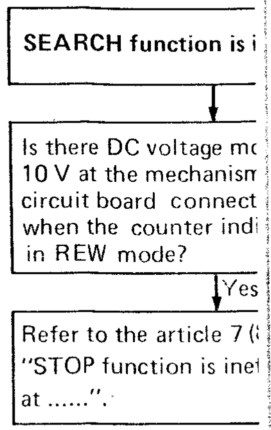

The Capstan Motor does not stop in STOP mode.
Defective function of the pinch slide lever.
Check up the UL-1 switch (S7).

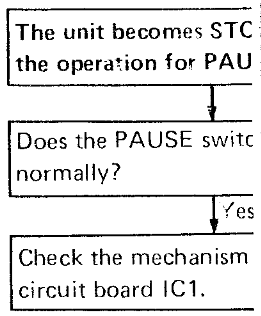
8-5-5 REW function is ineffective

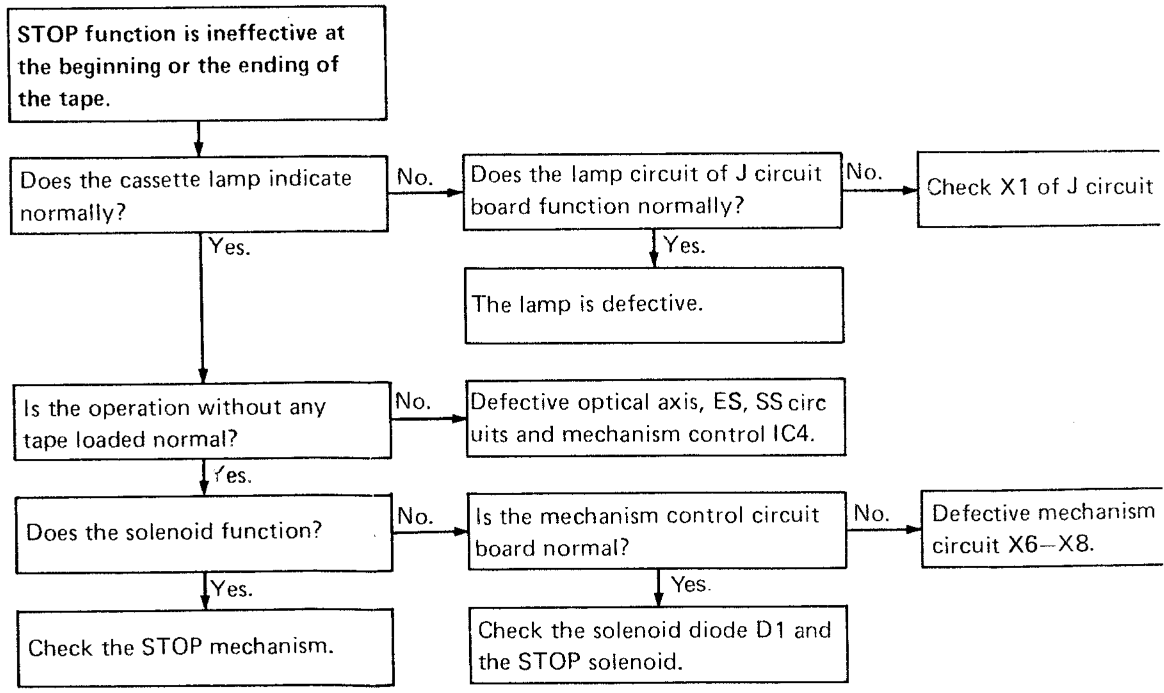

REW function is ineffective.
Does cassette switch S12 function normally?
No.
Check S12.
Yes.
Is FF function normal?
No.
Refer to the article "FF function is ineffective." (Previous page, 8-5-2.)
Yes.
Does the REW switch (S3) function?
No.
Check the switch(S3)and the concerned mechanism.
Yes.
Does the mechanism control circuit board function normally?
No.
IC3 is defective.
Yes.
Is the cassette tape tightly wrapped ?
Yes.
Repeat FF and REW operations 2 or 3 times without intermitting.

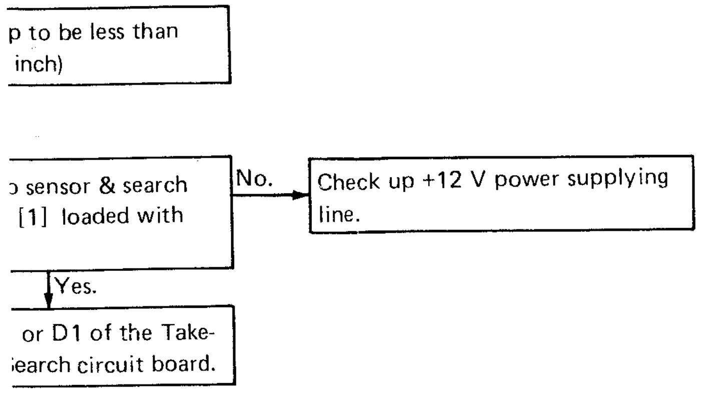
NOTE: All the above procedures for the subsection 8-5-5 should be done with a tape loaded.
Do not cover the photo transistors (END SENSOR, START SENSOR) with tape and the like.

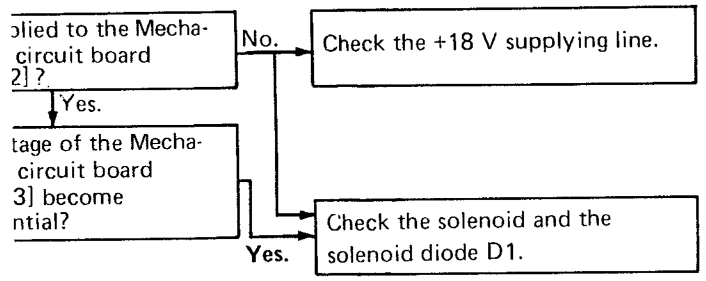
8-5-6 SEARCH funct


SEARCH function is i
Is there DC voltage mo 10 V at the mechanism circuit board connect when the counter indi in REW mode?
Yes
Refer to the article 7 ("STOP function is inef at ......".

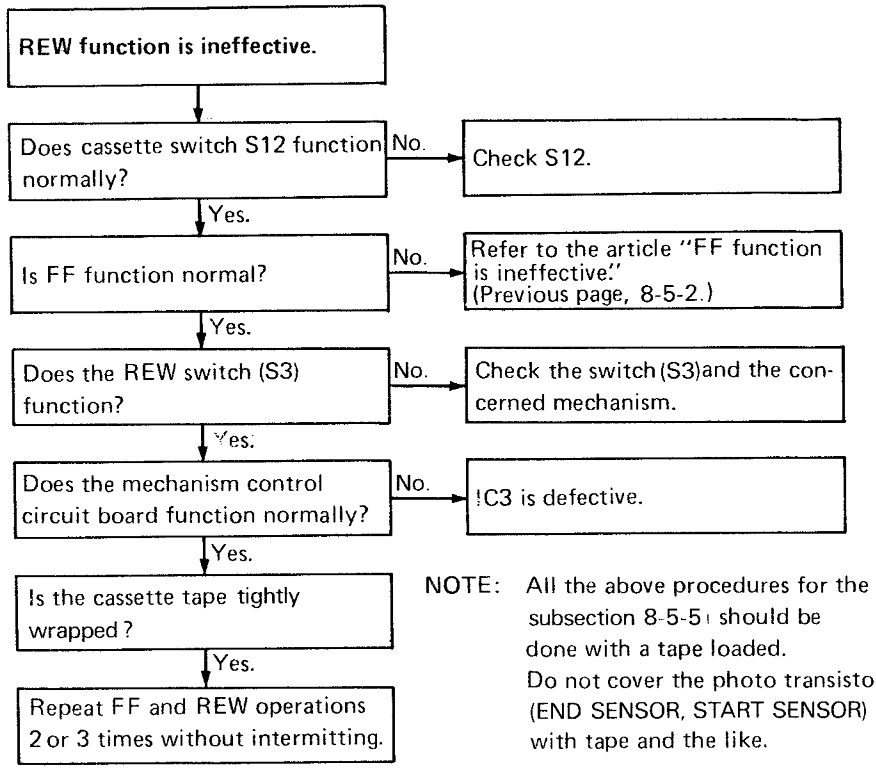

The unit becomes STO the operation for PAU
Does the PAUSE switc normally?
Yes
Check the mechanism circuit board IC1.


STOP function is ineffective at the beginning or the ending of the tape.
Does the cassette lamp indicate normally?
No.
Does the lamp circuit of J circuit board function normally?
No.
Check X1 of J circuit
Yes.
The lamp is defective.
Yes.
Is the operation without any tape loaded normal?
No.
Defective optical axis, ES, SS circuits and mechanism control IC4.
Yes.
Does the solenoid function?
No.
Is the mechanism control circuit board normal?
No.
Defective mechanism circuit X6—X8.
Yes.
Check the STOP mechanism.
Yes.
Check the solenoid diode D1 and the STOP solenoid.


p to be less than
inch)
ɔ sensor & search
[1] loaded with
No.
Check up +12 V power supplying line.
Yes.
or D1 of the Take-
ıearch circuit board.

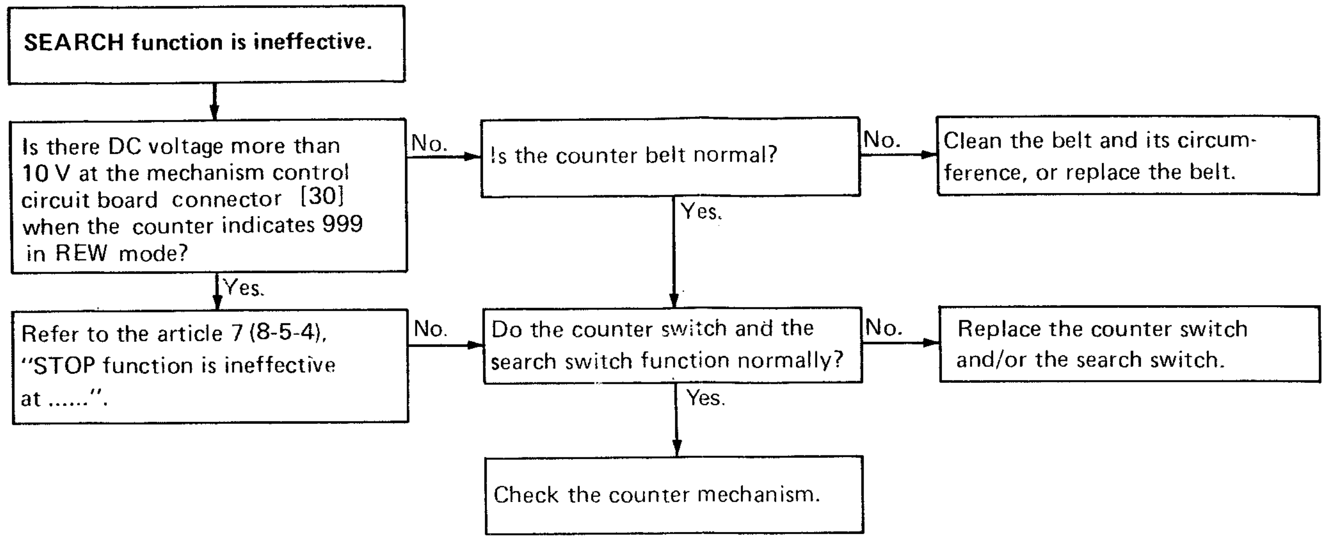

plied to the Mecha-
circuit board
2] ?
No.
Check the +18 V supplying line.
Yes.
tage of the Mecha-
circuit board
3] become
ntial?
Yes.
Check the solenoid and the solenoid diode D1.

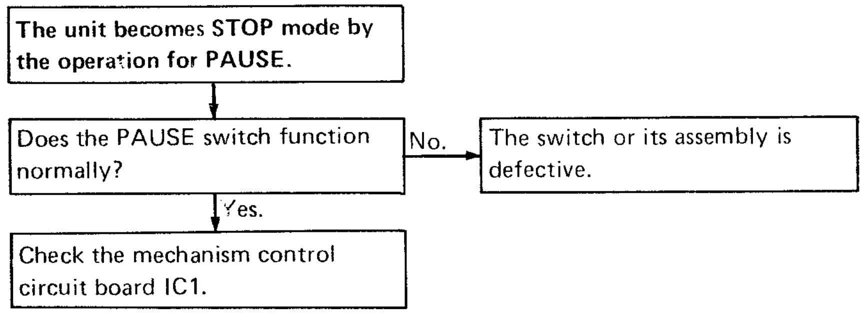
8-5-5 REW function is ineffective

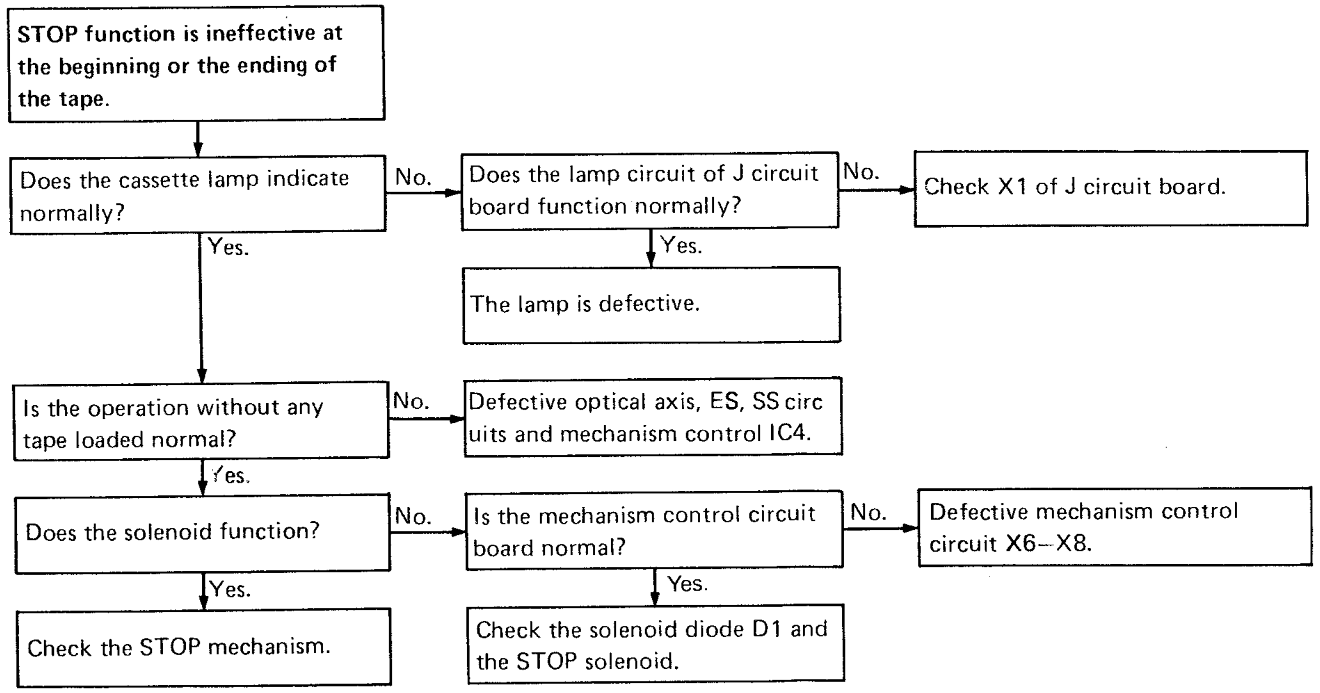

REW function is ineffective.
Does cassette switch S12 function normally?
No.
Check S12.
Yes.
Is FF function normal?
No.
Refer to the article "FF function is ineffective." (Previous page, 8-5-2.)
Yes.
Does the REW switch (S3) function?
No.
Check the switch (S3) and the concerned mechanism.
Yes.
Does the mechanism control circuit board function normally?
No.
IC3 is defective.
Yes.
Is the cassette tape tightly wrapped?
Yes.
Repeat FF and REW operations 2 or 3 times without intermitting.

NOTE: All the above procedures for the subsection 8-5-5 should be done with a tape loaded.
Do not cover the photo transistors (END SENSOR, START SENSOR) with tape and the like.

8-5-6 SEARCH function is ineffective


SEARCH function is ineffective.
Is there DC voltage more than 10 V at the mechanism control circuit board connector [30] when the counter indicates 999 in REW mode?
No.
Is the counter belt normal?
No.
Clean the belt and its circumference, or replace the belt.
Yes.
Yes.
Refer to the article 7 (8-5-4), "STOP function is ineffective at ......".
No.
Do the counter switch and the search switch function normally?
No.
Replace the counter switch and/or the search switch.
Yes.
Check the counter mechanism.


The unit becomes STOP mode by the operation for PAUSE.
Does the PAUSE switch function normally?
No.
The switch or its assembly is defective.
Yes.
Check the mechanism control circuit board IC1.


STOP function is ineffective at the beginning or the ending of the tape.
Does the cassette lamp indicate normally?
No.
Does the lamp circuit of J circuit board function normally?
No.
Check X1 of J circuit board.
Yes.
The lamp is defective.
Yes.
Is the operation without any tape loaded normal?
No.
Defective optical axis, ES, SS circuits and mechanism control IC4.
Yes.
Does the solenoid function?
No.
Is the mechanism control circuit board normal?
No.
Defective mechanism control circuit X6–X8.
Yes.
Check the solenoid diode D1 and the STOP solenoid.
Yes.
Check the STOP mechanism.

SECTION 9
EXPLODED VIEWS AND PARTS LIST

9-1 EXPLODED VIEW AND MAIN PARTS LIST
9-2 MAIN DECK – 1
9-3 MAIN DECK – 2
9-4 FUNCTION ASSEMBLY
9-5 DRUM ASSEMBLY
9-6 CASSETTE HOUSING ASSEMBLY
9-7 TUNER ASSEMBLY
9-8 CABINET ASSEMBLY

In this exploded views the part numbers of the screws and washers symbolize the shape of those items.
The following examples will help you to decipher them.

Examples:

SPSP3006ZS
"ISO" metric screw thread
Length in mm (6mm)
Diameter in mm (3mm)
Cross-recrossed, pan head screw

LPSP3014ZS
Length: 14mm
Diameter: 3mm
Cross-recrossed, pan head screw with lock washer

DPSP4008ZS
Diameter: 4 mm
Cross-recrossed, pan head screw with lock washer and plain washer

SSSP3008ZS
Cross-recrossed, flat countersunk head screw

SDBP3006NS
Cross-recrossed, binding head screw

YRS3004FS
Hexagon socket set screw with sunken tip

YFS3006FS
Hexagon socket screw with flat tip

BYS3006FS
Hexagon socket head bolt

WLS3000
Diameter of the screw applicable (3 mm screw)
Lock washer

WNS3000Z
Plain metal washer

REE4000
Diameter of the slot be around the face of the stud applicable (usually the stud's diameter is 5 mm and slot's one is 4 mm).
Retaining ring ("E" type)

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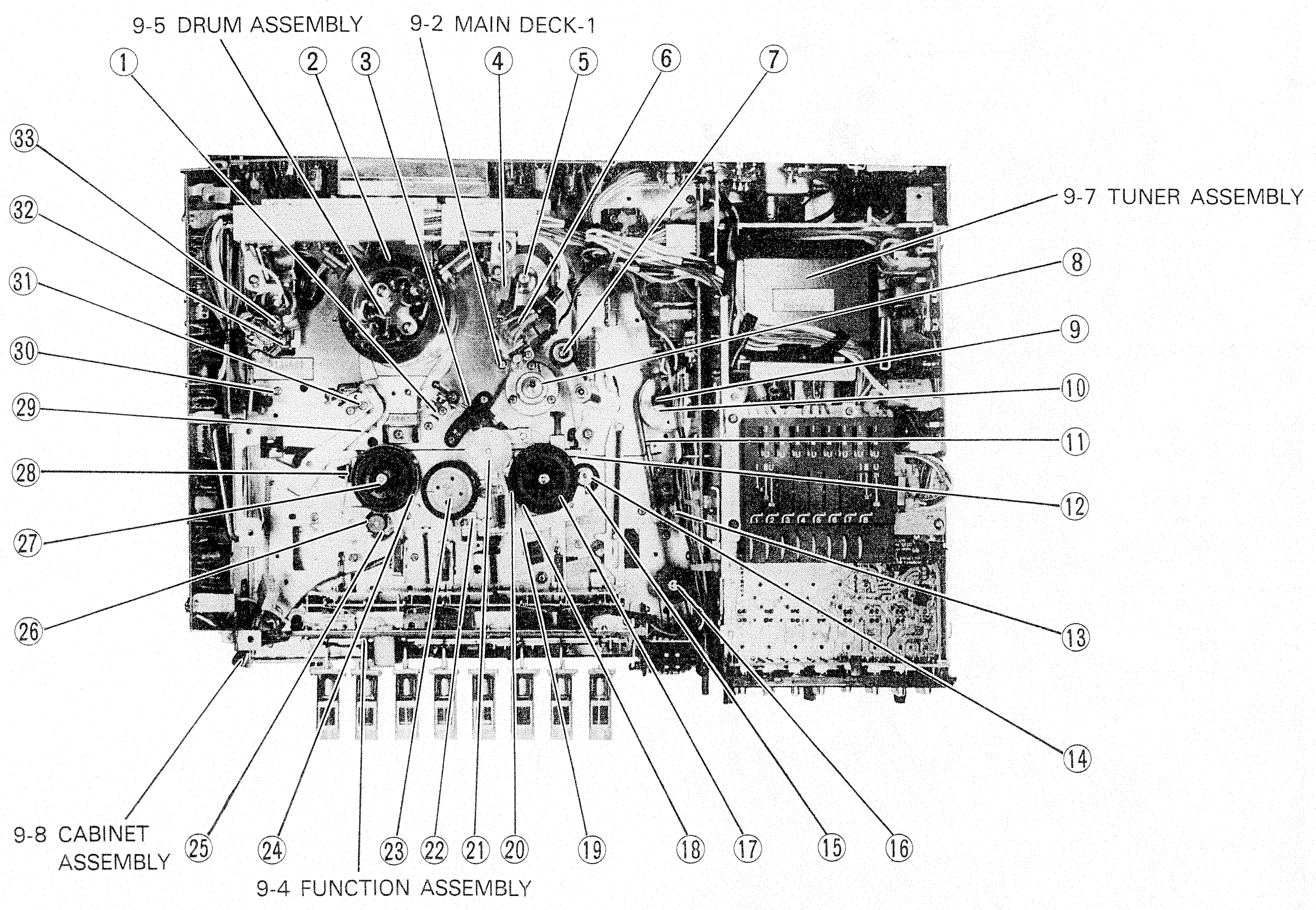
* For those not yet familiar with the international metric system. (the U.S. is presently in the process of conversion) one inch = approximately 25 millimeters (1 in. = 25.4 mm)

9-1 EXPLODED VIEW AND MAIN PARTS LIST

Upper View


9-5 DRUM ASSEMBLY
9-2 MAIN DECK-1
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9-7 TUNER ASSEMBLY
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⑩
⑪
⑫
⑬
⑭
9-8 CABINET ASSEMBLY
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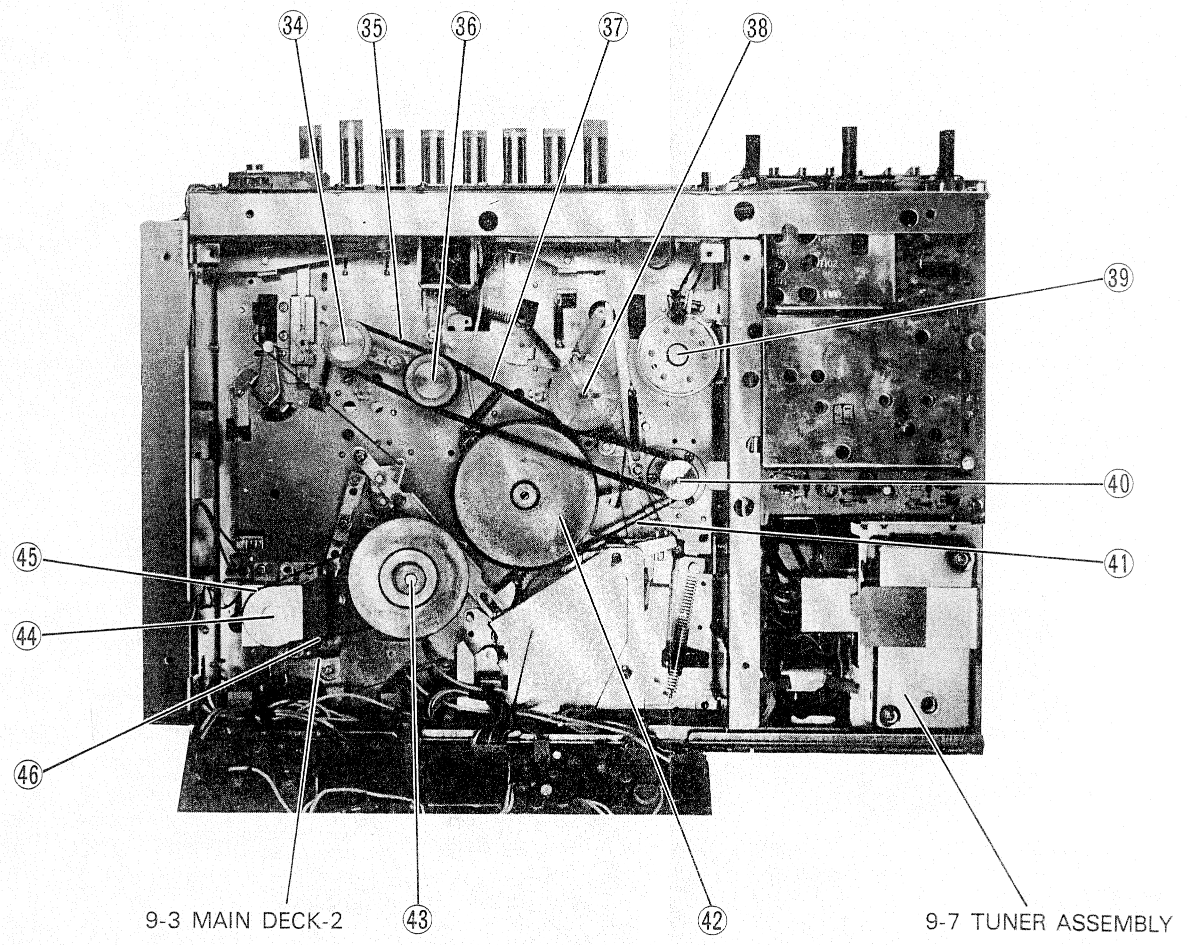
9-4 FUNCTION ASSEMBLY

Bottom View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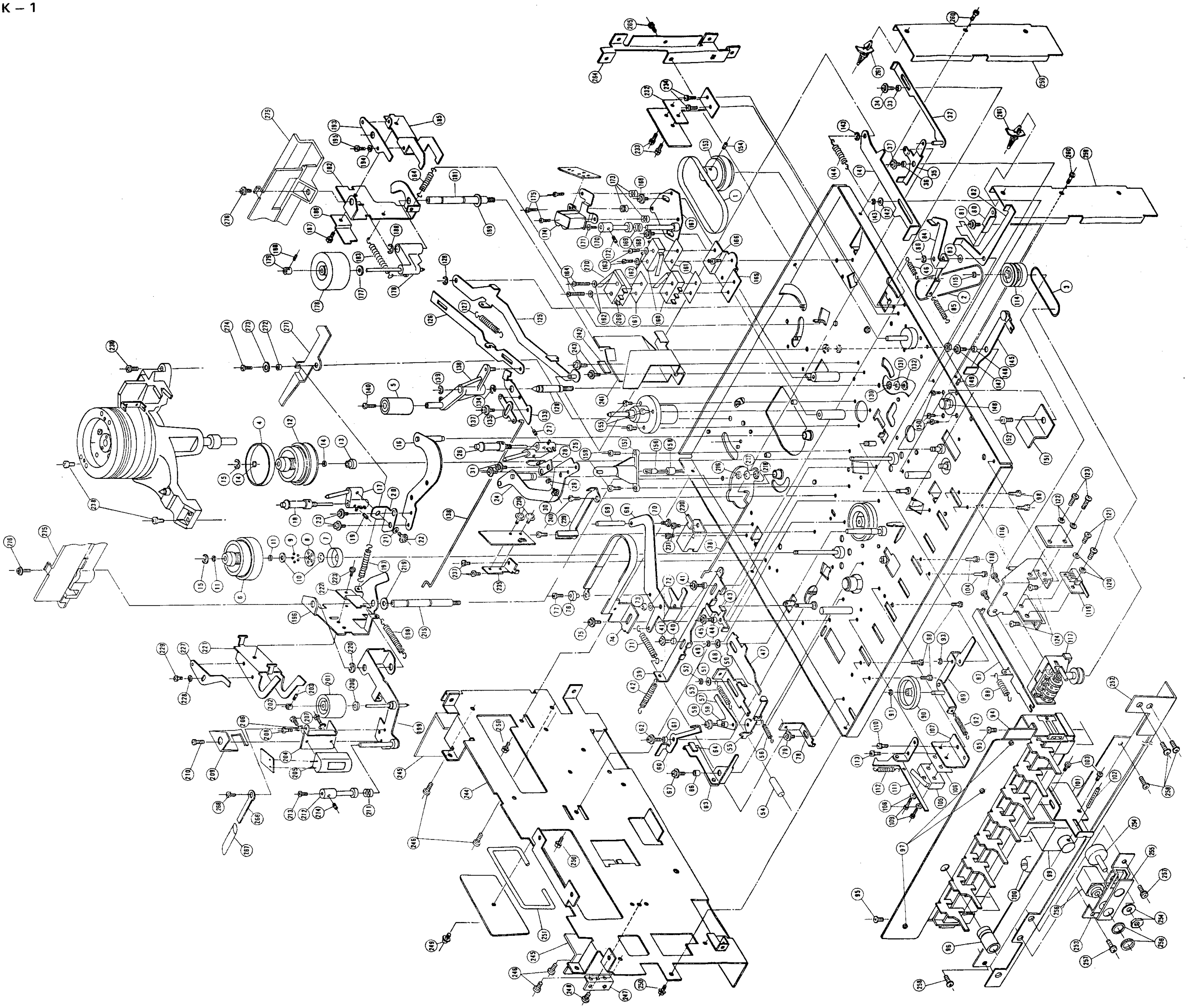
㊶
(45)
(44)
(46)
9-3 MAIN DECK-2
(43)
(42)
9-7 TUNER ASSEMBLY

Symbol No.	Part Name	Part No.	Symbol No.	Part Name	Part No.
1	Take-up Loading Arm	PU44979A	18	Take-up Reel Disk	PU44913A
2	Upper Drum	PU31332A	19	Take-up Brake	PU44839
3	Cassette Lamp	QLP3104-110	20	Take-up Loading Brake	PU44827A
4	Audio Erase Head Ass'y	PU45328A	21	FF Idler	PU44836
5	Take-up Impedance Roller	PU45355A	22	REW Rubber Tire	PU44918-2
6	Audio Control Head Ass'y	PU46023A	23	REW Idler	PU44924A
7	Pinch Roller Ass'y	PU45275A	24	Tension Band	PU44853A
8	Capstan Shaft Ass'y	PU45290A	25	Unloading Idler Ass'y	PU44944A
9	Start Sensor	–	26	Unloading Idler Rubber Tire	PU44918-3
10	Relay Pulley	PU44905-3	27	Supply Reel Disk	PU44922A
11	Relay Belt	PU44912	28	Loading Tension Brake	PUS45886
12	Take-up Reel Disk Rubber Tire	PU44918	29	Tension Arm	PU44851
13	Capstan Motor Pulley	PU44900-3	30	End Sensor	–
14	Take-up Idler	PU44936A	31	Supply Loading Arm	PU44982A
15	Counter Belt – 2	PU44863-2	32	Full Erase Head	PU31013
16	Counter Pulley	PU44861A	33	Supply Impedance Roller	PU45355B
17	Counter Belt – 1	PU44863			

Symbol No.	Part Name	Part No.	Symbol No.	Part Name	Part No.
34	Unloading Idler Ass'y	PU46381	41	Capstan Belt	PU44912-2
35	Unloading Belt	PU44912-3	42	Capstan Flywheel	PU45294A
36	Rewind Idler Ass'y	PU46380	43	Drum Pulley	PU44965A
37	Reel Drive Belt	PU44911	44	Drum Motor Pulley	PU45326
38	Take-up Idler Ass'y	PUS35652	45	Drum Motor	PU44619
39	Capstan Motor	PU45979P	46	Drum Motor Belt	PU44912-5
40	Relay Pulley (B)	PU44904			

9-2 MAIN DECK – 1



Symbol No.	Part No.	Part Name	Remarks
1	PU44912	Capstan Motor Belt	
2	PU44863	Counter Belt (1)	
3	PU44863-2	Counter Belt (2)	
4	PU44918	Take-up Reel Disc Rubber Tire	
5	PU45275A	Pinch Roller Ass'y	
6	PU44922A	Supply Reel Disc	
7	PU44919	Bearing Holder	
8	PU44920	Retainer	
9	PU41135-3	Steel Ball	
10	PU44921	Spacer	
11	Q03093-834	Washer	0.13 thick for adjusting reel disc height
	Q03093-827	Washer	0.25 thick ″
	Q03093-828	Washer	0.5 thick ″
12	PU44913A	Take-up Reel Disc Ass'y	
13	PU45789	Collar	
14	Q03093-834	Washer	0.13 thick for adjusting reel disc height
	Q03093-827	Washer	0.25 thick ″
	Q03093-828	Washer	0.5 thick ″
15	REE2000	"E" Ring	
16	PU44982A	Supply Loading Arm Sub Ass'y	
17	PU44949A	Supply Slant Pole Base Ass'y	
18	PU44952A	Guide Roller Ass'y	
19	YFS3004BS	Set Screw	
20	PU44957	Holder Bracket (Supply)	
21	T30302-025	Collar	
22	DPSP3008ZS	Screw	
23	DPSP3005ZS	Screw	
24	PU44979A	Take-up Loading Arm Sub Ass'y	
25	PU44958A	Take-up Slant Pole Base Ass'y	
26	PU44952A	Guide Roller Ass'y	
27	YFS3004BS	Set Screw	
28	PU44960	Holder Bracket (Take-up)	
29	T30302-025	Collar	
30	DPSP3008ZS	Screw	
31	DPSP3005ZS	Screw	
32	PU44891A	Slide Lever Ass'y	
33	T30302-008	Collar	
34	DPSP3006ZS	Screw	
35	PU44821	Connecting Lever	
36	PU43769-15	Collar	
37	DPSP3006ZS	Screw	
38	PU44822	Rod	
39	PU44825	Slide Plate	
40	T30302-005	Collar	
41	DPSP3006ZS	Screw	
42	PU35005-48	Spring	
43	PU44826	Safety Plate	
44	PU43769-15	Collar	
45	DPSP3006ZS	Screw	
46	PU35005-28	Spring	
47	PU45793	OFF Lever	
48	Q03093-502	Washer	
49	REE3000	"E" Ring	
50	PU44845	REW Lever	
51	Q03093-430	Washer	

Symbol No.	Part No.	Part Name	Remarks
52	REE2500	"E" Ring	
53	T30300-109	Spring	
54	QXT658H-010	Vinyl Tube	
55	PU44846	Idler Off Lever	
56	PU35005-50	Spring	
57	PU45376	Tension Arm Off Lever	
58	PU43769-19	Collar	
59	DPSP3006ZS	Screw	
60	PU44847	Tension Arm Cancel Lever	
61	PU43769-15	Collar	
62	DPSP3006ZS	Screw	
63	PU44830A	Supply Loading Tension Lever Ass'y	(65) Supply Loading Tensin Brake Ass'y
64	PU42199	Brake Shoe	
65	PUS45886	Supply Loading Tension Brake Ass'y	
66	PU43769-15	Collar	
67	DPSP3006ZS	Screw	
68	PU44851	Tension Arm	
69	PU44852	Tension Pole	
70	SSSP2606Z	Screw	
71	PU35005-80	Spring	
72	Q03093-430	Washer	
73	REE2500	"E" Ring	
74	PU44853A	Tension Band Ass'y	
75	DPSP3006ZS	Screw	
76	PU44859	Washer	
77	SPBP2006N	Screw	
78	PU44823	Bracket	
79	DPSP3006ZS	Screw	
80	PU44827A	Take-up Loading Brake Ass'y	
81	LPSP3006ZS	Screw	
82	PU44838	Loading Brake OFF Lever	
83	Q03093-104	Washer	
84	PU44839	Take-up Brake	
85	T30300-49	Spring	
86	REE2500	"E" Ring	
87	PU44837	F.F. Lever	
88	T30300-109	Spring	
89	PU44833A	F.F. Arm Ass'y	
90	PU44836	F.F. Idler	
91	REE2500	"E" Ring	
92	PU35005-28	Spring	
93	REE3000	"E" Ring	
94	PU31326	Operation P.C. Board Bracket	
95	LPSP3006ZS	Screw	
96	PU44887	Lamp Bush	
97	LPSP3006ZS	Screw	
98	LPSP3006ZS	Screw	
99	PU44623	Solenoid	
100	V03C	Diode	
101	PU44864	Solenoid Bracket	
102	PRE3025	Spring Pin	
103	LPSP3005ZS	Screw	
104	LPSP3006ZS	Screw	
105	QSM1S01-028	Microswitch	
106	PU44212	Spacer	

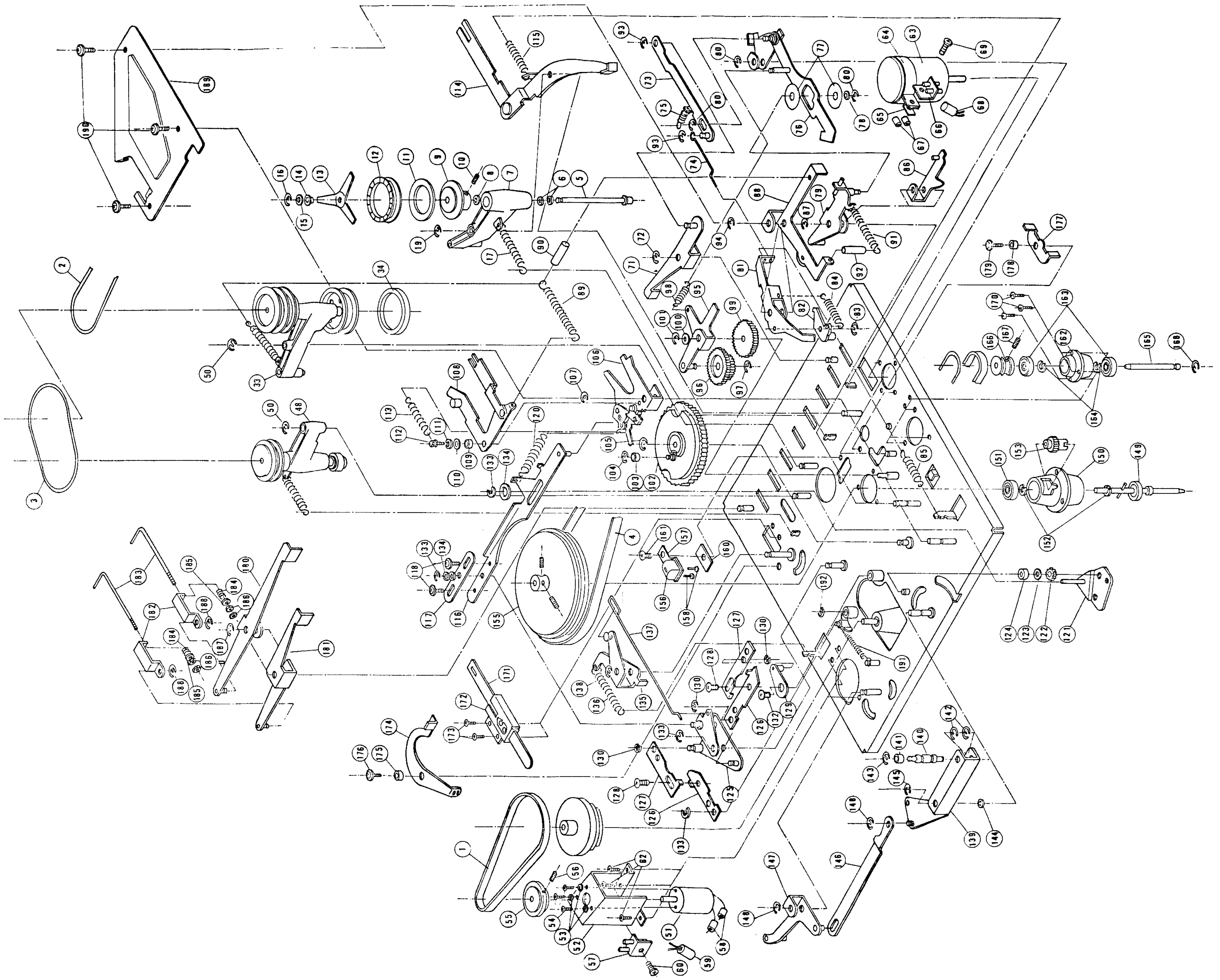
Symbol No.	Part No.	Part Name	Remarks
107	PU45459	Switch Bracket	
108	WLS2300N	Lock Washer	
109	SPBP2310N	Screw	
110	LPSP3006ZS	Screw	
111	PU44848A	REC Safety Lever Ass'y	
112	PU35005-34	Spring	
113	LPSP3006ZS	Screw	
114	PU44861A	Counter Pulley Ass'y	
115	REE2500	"E" Ring	
116	PU45873A	Counter Bracket Ass'y	
117	PU44669	Tape Counter	
118	LPSP3005ZS	Screw	
119	PU44738	Push Switch	S10 (Search SW)
120	WLS2000N	Lock Washer	
121	SPSP2004Z	Screw	
122	WLS2000N	Lock Washer	For Take-up Sensor Circuit Board
123	SPSP2004Z	Screw	
124	LPSP3006ZS	Screw	
125	PU45283A	Pinch Roller Slide Plate(1) Ass'y	
126	PU45286	Pich Slide Plate (2)	
127	T30300-021	Spring	
128	REE3000	"E" Ring	
129	PU45343	Pinch Roller Shaft	
130	WLS4000	Lock Washer	
131	WBS4000	Washer	
132	NNB4000NS	Nut	
133	PU44878	Pause Lever	
134	REE5000	"E" Ring	
135	PU44879	Adjusting Plate	
136	PU44877	Rod	
137	DPSP3006ZS	Screw	
138	PU45279A	Pich Roller Lever Ass'y	
139	REE5000	"E" Ring	
140	LPSP2604Z	Screw	
141	PU44824	Memory Plate	
142	Q03093-502	Washer	
143	REE3000	"E" Ring	
144	PU35005-40	Spring	
145	PU44840A	Eject Plate Ass'y	
146	T30302-008	Collar	
147	DPSP3006ZS	Screw	
148	PU44900-3	Capstan Motor Pulley	
149	YWS3003PS	Set Screw	
150	LPSP3005ZS	Screw	
151	PU45660	Belt Guard	
152	LPSP3006ZS	Screw	
153	PU44905-3	Relay Pulley (A)	
154	YWS3004PS	Set screw	
155	LPSP3006ZS	Screw	for Capstan Holder
156	QLP3104-110	Cassette Lamp	
157	PU44893	Lamp Holder	
158	PU44894	Stopper	
159	LPSP3006ZS	Screw	
160	QSM1S01-028	Microswitch	
161	PU44212	Spacer	

Symbol No.	Part No.	Part Name	Remarks
162	WLS2300N	Lock Washer	
163	SPBP2310N	Screw	
164	SPBP2318N	Screw	
165	PU44898	Switch Bracket	
166	LPSP3006ZS	Screw	
167	PU45331A	Audio/Control Head Base Ass'y	
168	DPSP3006ZS	Screw	
169	PU30080-49	Spring	
170	PU45271-2	Take-up Guide Pole	
171	SDBP3006RS	Screw	
172	YFS3004BS	Setscrew	
173	PU30080-49	Spring	
174	PU46023A	Audio/Control Head Sub Ass'y	
175	SPSP2610Z	Screw	
176	PU45256A	Take-up Arm Ass'y	
177	Q03093-829	Washer	
178	PU45355A	Take-up Impedance Roller Ass'y	
179	PU45260	Stopper	
180	YWS3003PS	Setscrew	
181	PU45345-2	Stud	
182	PU45261	Lever	
183	PU35005-42	Spring	
184	T30300-114	Spring	
185	PU45262	Take-up Lock Arm	
186	PU45263	Spring Plate	
187	LPSP3006ZS	Screw	
188	REE5000	"E" Ring	
189	Q03093-508	Washer	
190	–	–	
191	–	–	
192	–	–	
193	PU45354	Take-up Guide Roller Stopper	
194	WNB2600N	Washer	
195	SPSP2603Z	Screw	
196	PU45272	Lever	
197	PU35005-14	Spring	
198	PU35005-86	Spring	
199	PU45264A	Head Arm Ass'y	
200	Q03093-830	Washer	
201	PU45355B	Supply Impedance Roller Ass'y	
202	PU45260	Stopper	
203	YWS3003PS	Setscrew	
204	PU45270	Full Erase Head Holder	
205	PU31013	Full Erase Head	
206	WLS2000N	Lock Washer	
207	SPBP2004N	Screw	
208	SPSP3006ZS	Screw	
209	PU45484	Stopper	
210	LPSP3005ZS	Screw	
211	PU30080-49	Spring	
212	PU45271	Supply Guide Pole	
213	SDBP3006RS	Screw	
214	YFS3004BS	Setscrew	
215	PU45822	Stud	
216	WLS4000	Lock Washer	

Symbol No.	Part No.	Part Name	Remarks
217	WBS4000	Washer	
218	NNB4000NS	Nut	
219	Q03093-508	Washer	
220	REE5000	"E" Ring	
221	PU45273	Supply Lock Arm	
222	PU45263	Spring Plate	
223	LPSP3006ZS	Screw	
224	–	–	
225	–	–	
226	–	–	
227	PU45353	Supply Guide Roller Stopper	
228	WNB2600N	Washer	
229	SPSP2603Z	Screw	
230	PU45274	Guide	
231	LPSP3006ZS	Screw	
232	PU46396	Start Sensor P.C.Board Bracket	
233	DPSP3006ZS	Screw	for Start Sensor P.C. Board
234	LPSP3006ZS	Screw	
235	PU44895	End Sensor P.C. Board Bracket	
236	DPSP3006ZS	Screw	for End Sensor P.C. Board
237	LPSP3006ZS	Screw	
238	DPSP3010ZS	Screw	for Drum Ass'y
239	PU44906	Stopper	
240	LPSP3006ZS	Screw	
241	PU31399	Cassette Door Guide	
242	PU46356	Cushion	
243	DPSP3006ZS	Screw	
244	PU20530A	Side Bracket	
245	PU44744	Side Holder	
246	LPSP3006ZS	Screw	
247	PU44763	Guide Bracket	
248	LPSP3006ZS	Screw	
249	DPSP3006ZS	Screw	for Power Transistor P.C. Board
250	LPSP3006ZS	Screw	for Side Bracket
251	PU45378	Handle	
252	PU20537	Front Stay	
253	PU45997	MIC. Jack Holder	
254	QVF166B-0F5	Variable Resistor	for TRACKING
255	PU45998	Mic. Panel	
256	QMS6303-003	Mic. Jack Ass'y	
257	LPSP3006ZS	Screw	
258	LPSP3006ZS	Screw	
259	PU44795	Foot	
260	LPSP3006ZS	Screw	
261	PU43146-2	Circuit Board Supporter	
262	PU20538	Rear Stay	
263	LPSP3006ZS	Screw	
264	PU44747-2	Circuit Board Holder	
265	LPSP3006ZS	Screw	
266	55234	Wire Clamp	
267	QXT3320-625	Vinyl Tube	
268	LPSP3006ZS	Screw	
269	QSM1S01-014	Microswitch	
270	PU46389	Spring	
271	PU46086	Lock Lever	

Symbol No.	Part No.	Part Name	Remarks
272	T30302-004	Collar	
273	Q03091-105	Washer	
274	DPSP3005ZS	Screw	
275	PU31492	Wire Housing	
276	DPSP3006ZS	Screw	

9-3 MAIN DECK – 2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Symbol No.	Part No.	Part Name	Remarks
1	PU44912-5	Drum Belt	
2	PU44911	Rew. Idler Belt	
3	PU44912-3	Unloading Idler Belt	
4	PU44912-2	Capstan Belt	
5	PU44936A	Take-up Idler Shaft Ass'y	
6	Q03093-825	Washer	
7	PU44939A	Take-up Idler Arm Ass'y	
8	Q03093-826	Washer	
9	PU44941A	Friction Disc (B) Ass'y	⑱ Take-up Idler Ass'y
10	YWS3004PS	Setscrew	
11	PU44933	Felt	
12	PU44942A	Take-up Pulley Ass'y	
13	PU44943	Spring	
14	PU44935	Spring Guide	
15	Q03093-*	Washer	*-825 (0.25 t), *-826 (0.5 t)
16	REE2500	"E" Ring	
17	PU35005-14	Spring	
18	PUS35652	Take-up Idler Ass'y	
19	REE3000	"E" Ring	
20	–	–	
21	–	–	
22	–	–	
23	–	–	
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27	–	–	
28	–	–	
29	–	–	
30	–	–	
31	–	–	
32	–	–	
33	PU46380	REW Idler Ass'y	
34	PU44918-2	REW Rubber Tire	
35	–	–	
36	–	–	
37	–	–	
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39	–	–	
40	–	–	
41	–	–	
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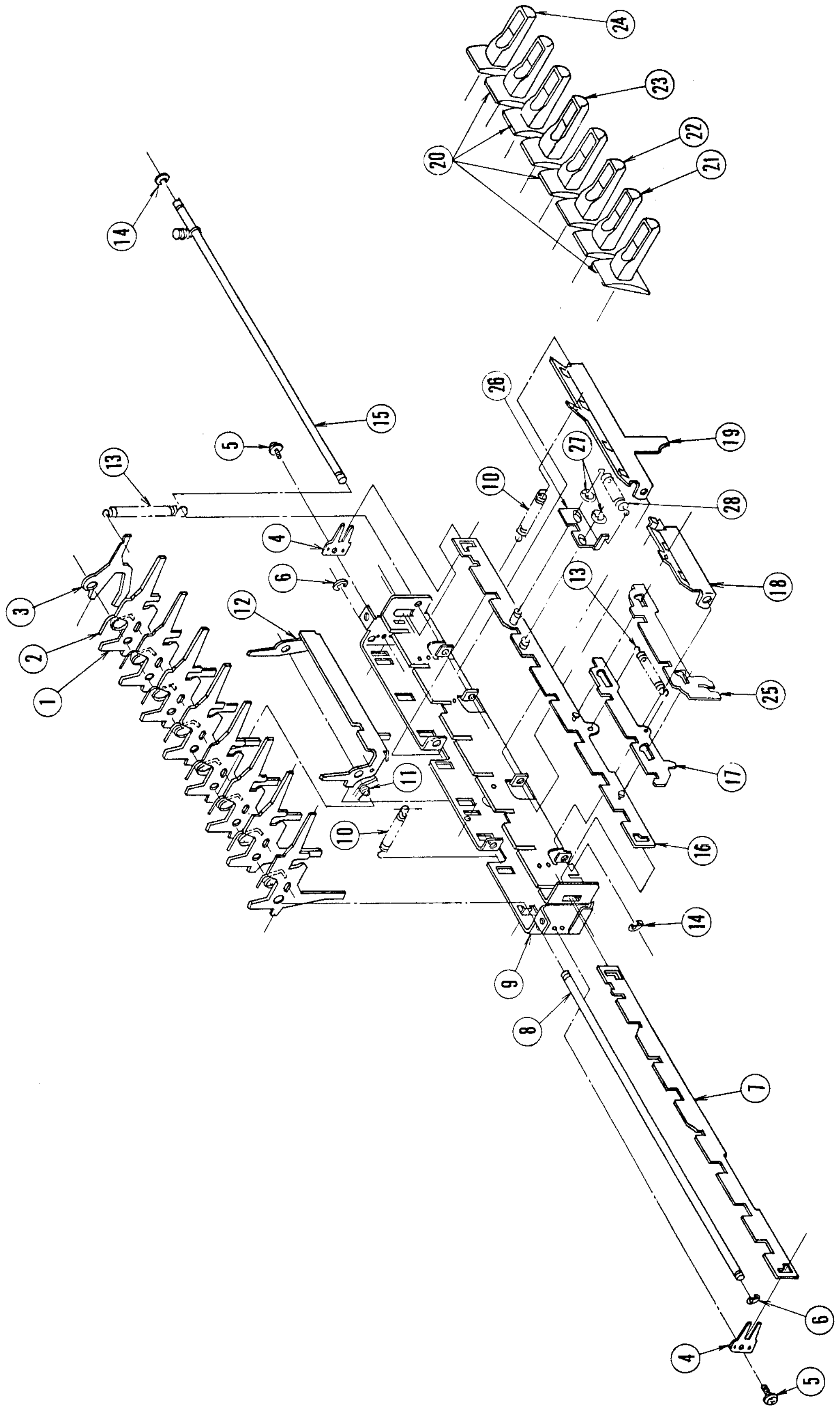
46	–	–	
47	–	–	
48	PU46381	Unloading Idler Ass'y	
49	–	–	
50	REE3000	"E" Ring	
51	PU44619	Drum Motor	
52	PU31335	Drum Motor Bracket	
53	WLS2000N	Lock Washer	
54	SPBP2004N	Screw	
55	PU45326	Drum Motor Pulley	

Symbol No.	Part No.	Part Name	Remarks
56	YWS3003PS	Setscrew	
57	V03082-2	Feed Through Capacitor Ass'y	
58	PU45811	Ferrite Beads	
59	QEW41HA-105	Electrolytic Capacitor	
60	DPSP3006ZS	Screw	
61	—	—	
62	LPSP3004ZS	Screw	
63	PU45979P	Capstan Motor	
64	PU45980	Capstan Motor Band	
65	PU43730	Tapping Plate	
66	V03082-2	Feed Through Capacitor Ass'y	
67	PU45811	Ferrite Beads	
68	QEW41HA-105	Electrolytic Capacitor	
69	LPSP3010ZS	Screw	
70	—	—	
71	PU45313A	PLAY Lever (1) Ass'y	
72	REE3000	"E" Ring	
73	PU45319A	PLAY Lever (2) Ass'y	
74	PU45321	Rod	
75	PU35005-6	Spring	
76	PU45315A	PLAY Lever (3) Ass'y	
77	Q03093-620	Washer	
78	Q03093-102	Washer	
79	PU45299A	Change Lever Ass'y	
80	REE3000N	"E" Ring	
81	PU45306A	Change Arm Lock Lever Ass'y	
82	PU45308A	Drive Arm Lock Lever Ass'y	
83	REE3000	"E" Ring	
84	PU35005-53	Spring	
85	PU35005-16	Spring	
86	PU45301A	Kick Lever Ass'y	
87	REE5000	"E" Ring	
88	PU45303A	Timing Arm Ass'y	
89	PU35005-76	Spring	
90	QXT665H-025	Vinyl Tube	
91	T30300-003	Spring	
92	QXT652H-020	Vinyl Tube	
93	REE3000	"E" Ring	
94	REE5000	"E" Ring	
95	PU45296A	Gear Arm Ass'y	
96	PU43547	Change Gear	
97	REE2500	"E" Ring	
98	T30300-029	Spring	
99	PU45298	Stepped Gear	
100	Q03093-424	Washer	
101	REE3000	"E" Ring	
102	PU45311A	Timing Gear Ass'y	
103	PU43769-22	Collar	
104	REE3000	"E" Ring	
105	REE4000	"E" Ring	
106	PU45242A	Drive Arm Ass'y	
107	REE5000	"E" Ring	
108	PU45247A	Change Arm Ass'y	Incl. Collar(PU43769-18),"E"Ring(REE3000)
109	T30302-025	Collar	
110	Q03091-103	Washer	

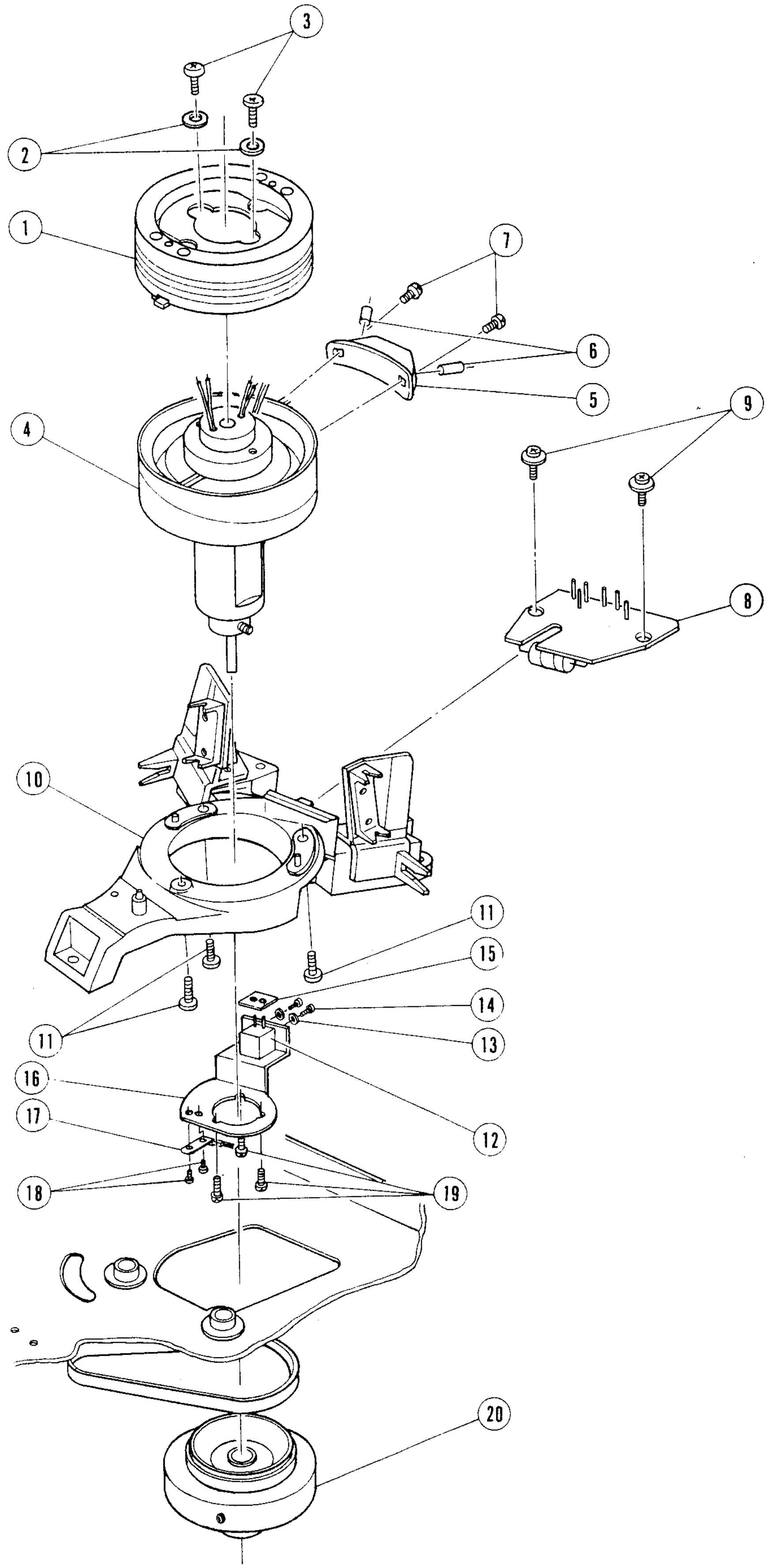
Symbol No.	Part No.	Part Name	Remarks
111	WLS3000	Lock Washer	
112	PU44224	Spring Hook	
113	PU35005-74	Spring	
114	PU45322A	Lock Lever Ass'y	
115	PU35005-86	Spring	
116	PU45238A	Slide Plate Ass'y	
117	PU45240	Plate	(119) Slide Plate Ass'y
118	DPSP3006ZS	Screw	
119	PUS45951	Slide Plate Ass'y	
120	PU35005-75	Spring	
121	PU45818A	Spring Plate Ass'y	
122	WLS4000	Lock Washer	
123	WBS4000	Washer	
124	NNB4000NS	Nut	
125	PU44987A	Rotary Lever Ass'y	
126	PU45821	Adjusting Plate (1)	
127	PU45820	Adjusting Plate (2)	(131) Stepped Lever Ass'y
128	BPSP3005ZS	Screw	
129	PU44985A	Supply Lever Ass'y	
130	REE3000	"E" Ring	
131	PU45836A	Stepped Lever Ass'y	
132	DPSP3006ZS	Screw	
133	REE3000	"E" Ring	
134	Q03093-502	Washer	
135	PU44881A	Tension Cam Ass'y	
136	T30300-78	Spring	
137	PU44883	Rod	
138	REE3000	"E" Ring	
139	PU45250A	Take-up Lock Lever Ass'y	
140	PU45252	Stud	
141	PU43769-23	Collar	
142	REE4000	"E" Ring	
143	REE3000	"E" Ring	
144	Q03093-507	Washer	
145	REE5000	"E" Ring	
146	PU45255	Connecting Lever	
147	PU45253B	Supply Lock Lever Ass'y	
148	REE3000	"E" Ring	
149	PU45290A	Capstan Shaft Ass'y	
150	PU45288	Capstan Holder	
151	PU43895	Bearing	(154) Capstan Holder Ass'y
152	RCSB12000	"C" Ring	
153	PU45289	Gear (1)	
154	PU45287A	Capstan Holder Ass'y	
155	PU45294A	Capstan Flywheel Ass'y	Incl. Setscrew (YWS3004PS) x 2
156	PU45138	Pick-up Head	
157	PU44909	Head Bracket	(159) Capstan Pick-up Head Ass'y
158	SPBP2002N	Screw	
159	PU44908A	Capstan Pick-up Head Ass'y	
160	PU44766	Insulator	
161	LPSP3006ZS	Screw	
162	PU44902	Holder	
163	PU43895	Bearing	
164	RCSB12000	"C" Ring	
165	PU44903	Relay Pulley Shaft	(169) Relay Pulley Ass'y
166	PU44904	Relay Pulley (B)	
167	YWS3004PS	Setscrew	
168	REE3000	"E" Ring	
169	PU44901A	Relay Pulley Ass'y	
170	LPSP3006ZS	Screw	
171	PU44871A	Pause Lever Ass'y	
172	PU44874A	Lock Bracket Ass'y	
173	LPSP3006ZS	Screw	
174	PU44876	Closed Lever	
175	T30302-004	Collar	
176	DPSP3006ZS	Screw	
177	PU44880	Take-up Idler OFF Lever	
178	PU43769-15	Collar	
179	DPSP3006ZS	Screw	
180	PU44865A	Full Record (REC) Lever Ass'y	
181	PU44867A	After Record (DUB) Lever Ass'y	
182	PU44869	Connecting Lever	
183	PU44870	Rod	
184	PU30080-46	Spring	
185	WNB2300N	Washer	
186	NNB2300N	Nut	
187	REE3000	"E" Ring	
188	REE2500	"E" Ring	
189	PU45325	Plate	
190	DPSP3006ZS	Screw	
191	T30300-029	Spring	
192	REE4000	"E" Ring	

9-4 FUNCTION ASSEMBLY



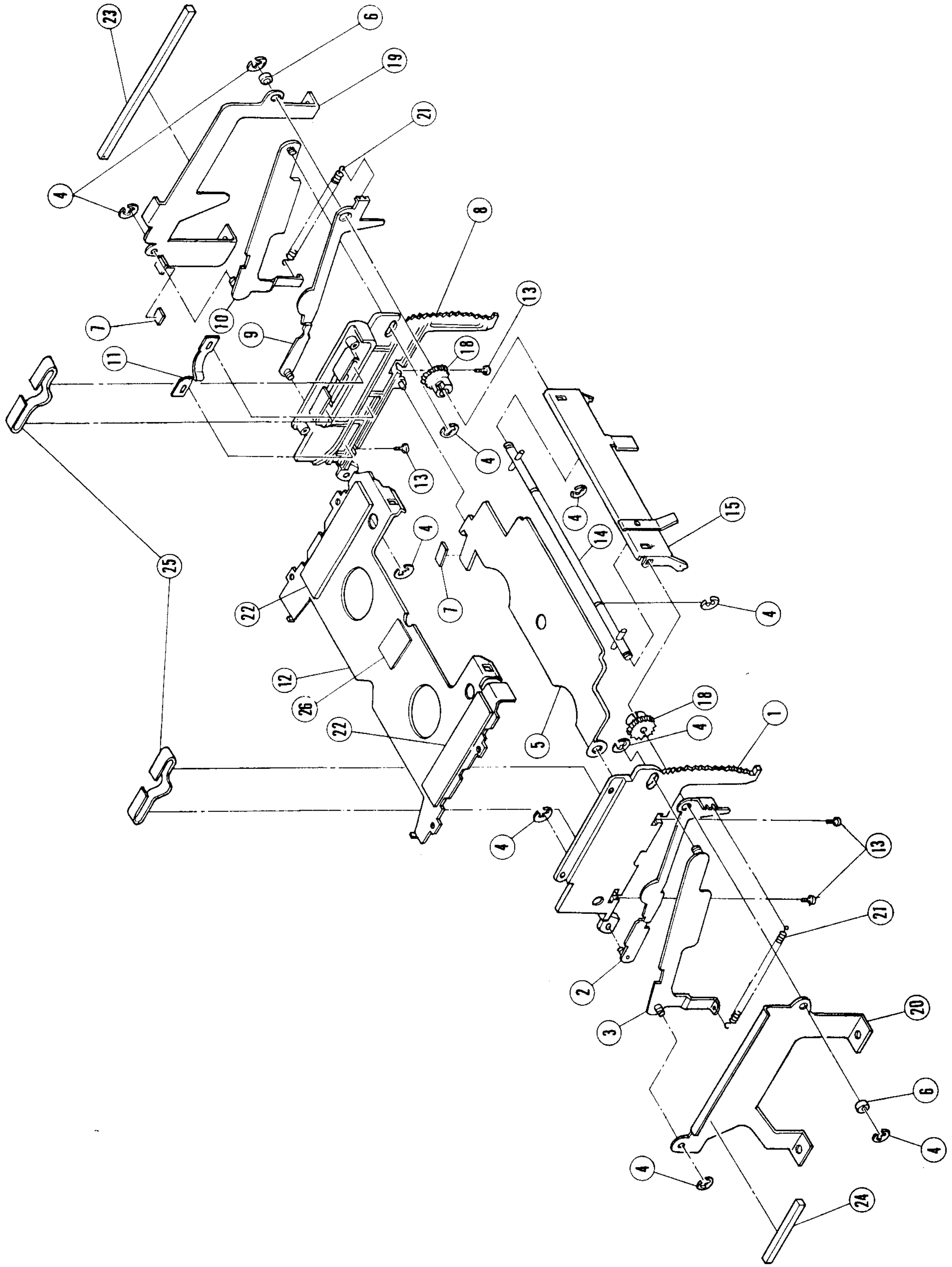
Symbol No.	Part No.	Part Name	Remarks
1	PU44799	Lever	㉙ Function Ass'y
2	PU45800	Return Spring	
3	PU44800	Lock Lever	
4	PU44802	Flat Spring	
5	DPSP3006ZS	Screw	
6	REE3000	"E" Ring	
7	PU31322	Function Plate (A)	
8	PU44801	Shaft	
9	PU20540	Button Case	
10	PU35005-28	Spring	
11	PU44231	Spring	
12	PU31321	Swing Plate	
13	PU35005-22	Spring	
14	REE2500	"E" Ring	
15	PU44806	Shaft	
16	PU31323A	Function Plate (B) Ass'y	
17	PU44803	Function Plate (C)	
18	PU44805	Lock Plate (S)	
19	PU44804	Lock Plate (L)	
20	PU44808A	Button Ass'y (A)	
21	PU44808B	Button Ass'y (B)	
22	PU44808D	Button Ass'y (D)	
23	PU44808E	Button Ass'y (E)	
24	PU44808C	Button Ass'y (C)	
25	PU45856	Function Plate (E)	
26	PU45539	Function Plate (D)	
27	REE2500	"E" Ring	
28	PU35005-72	Spring	
29	PUS25490	Function Ass'y	

9-5 DRUM ASSEMBLY



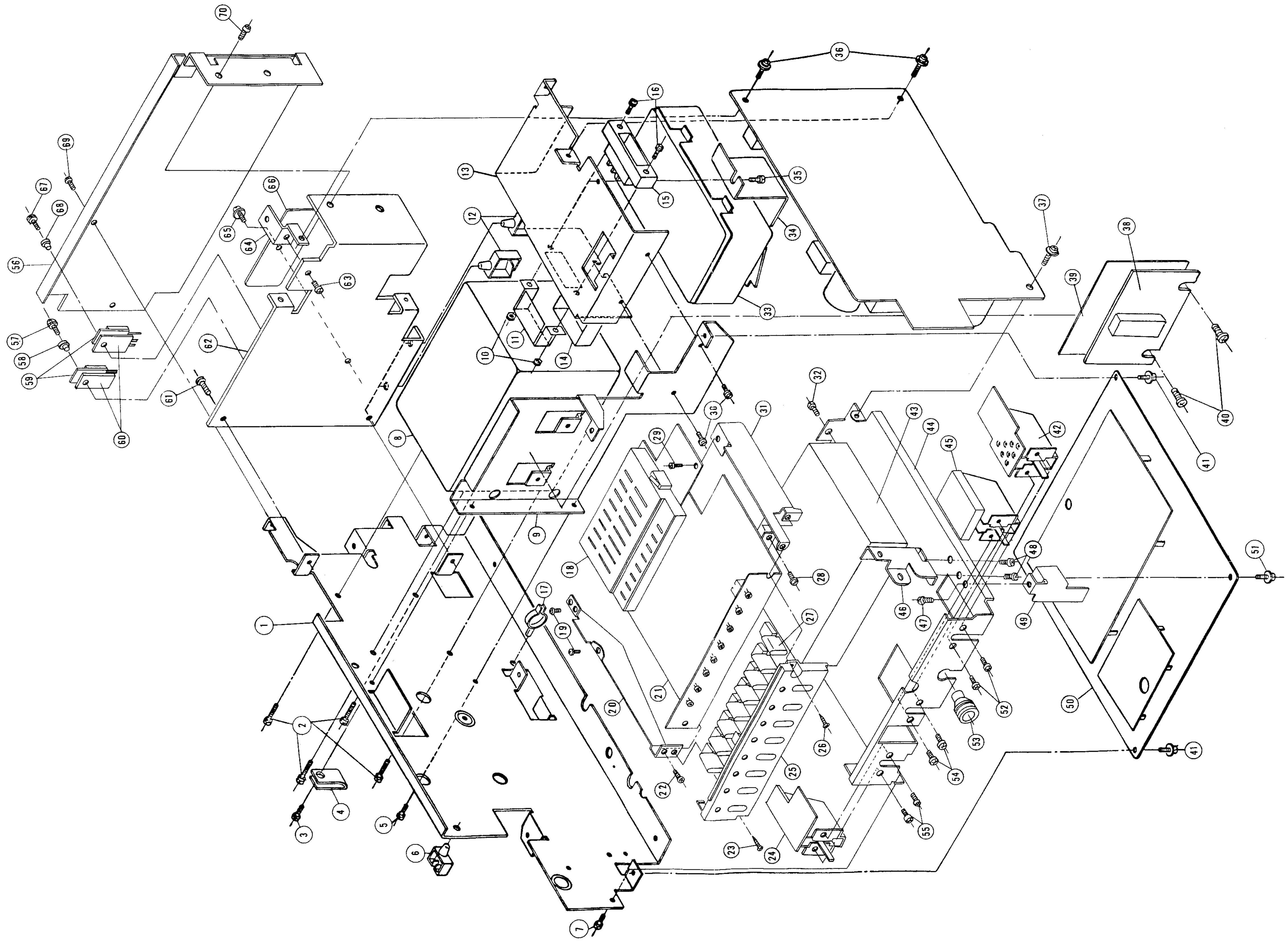
Symbol No.	Part No.	Part Name	Remarks
1	PU31332D	Upper Drum Ass'y	
2	WNB3000N	Washer	
3	SPBP3010NS	Screw	
4	PU31328D	Lower Drum Sub Ass'y	
5	PU44973A	Heater Ass'y	
6	QXTG259-015	Tube	
7	SDBP3006NS	Screw	
8	PU44973A	Heater Circuit Board Ass'y	
9	DPSP3006ZS	Screw	
10	DPSP3006ZS	Drum Base Ass'y	
11	SDBP3008NS	Screw	
12	PU45138	Pick-up Head	
13	WSB2000N	Washer	
14	SPBP2003N	Screw	
15	PU44766	Insulator	
16	PU44971	Pick-up Head Bracket	
17	PU44972	Brush Ass'y	
18	SPBP2003N	Screw	
19	LPSP2606Z	Screw	
20	PU44965A	Drum Pulley Ass'y	Incl. Setscrew (YFS4006)

9-6 CASSETTE HOUSING ASSEMBLY



Symbol No.	Part No.	Part Name	Remarks
1	PU20544	Housing	Left side
2	PU31336B	Lower Arm Ass'y	Left side
3	PU45360A	Upper Arm Ass'y	Left side
4	REE4000	"E" Ring	
5	PU31238	Cover	
6	PU43769-6	Collar	
7	PU45673	Cushion	
8	PU20543	Housing	Right side
9	PU31336A	Lower Arm Ass'y	Right side
10	PU45360B	Upper Arm Ass'y	Right side
11	PU45550	Off Spring	
12	PU31337	Plate	
13	LPSP2606Z	Screw	㉗ Cassette Housing Ass'y
14	PU45363A	Shaft Ass'y	
15	PU41391A	Lock Lever Ass'y	
16	—	—	
17	—	—	
18	PU45364	Gear	
19	PU45358	Bracket	Right side
20	PU45909	Bracket	Left side
21	T30300-93	Spring	
22	PU40867-2	Felt-1	
23	PU45509-2	Shade	
24	PU45509-3	Shade	
25	PU45549	Spring	
26	PU40867-3	Felt-2	
27	PUS25491-0B	Cassette Housing Ass'y	

9-7 TUNER ASSEMBLY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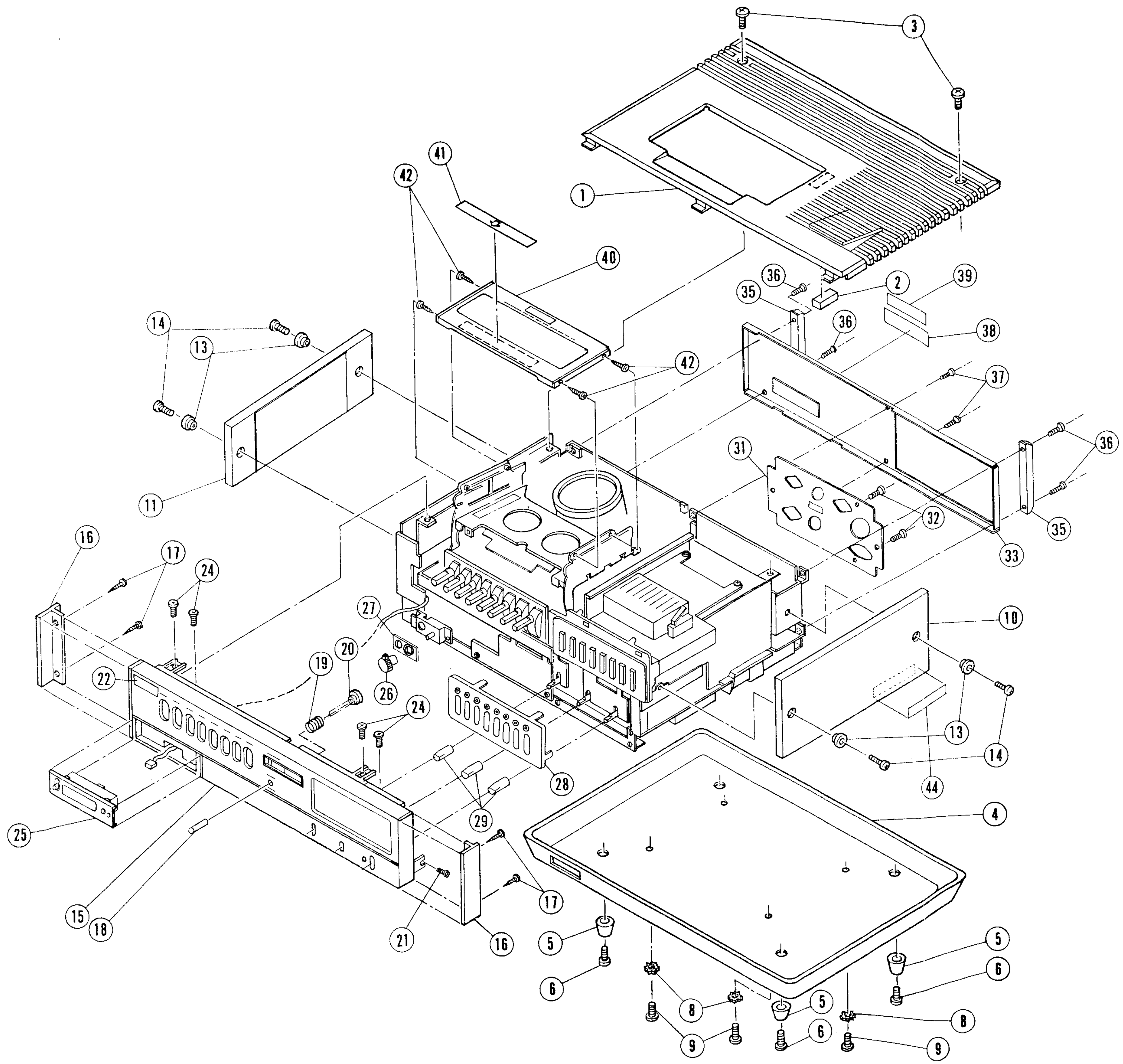
Tuner Assembly

Symbol No.	Part No.	Part Name	Remarks
1	A27436	Side Bracket	
2	LPSP3006ZS	Screw	
3	DPSP3008ZS	Screw	
4	PU43160	Cord Clamp	
5	LPSP3006ZS	Screw	
6	A47849	Wire Clip	
7	C40500	Tap Screw	
8	C39001A	Power Transformer	
9	A38193	Transformer Bracket	
10	NNS3000NS	Nut	
11	PU44778	RF Shield	
12	PU43147-2	Wire Clip	
13	PU31304-2	RF Holder (1)	
14	PU44779	RF Shield Cover	
–	PU42089	Feed Through Capacitor	C1, 4
–	PU42273	Feed Through Capacitor	C5
–	PU42088	Feed Through Capacitor	C2 RF Connector Terminal (Inside RF Shield)
–	PU43295	Band Pass Filter	
–	QCF11HP-103	Ceramic Capacitor	C3
15	PU45160	Connector	
16	LPSP30012ZS	Screw	
17	A39808-2	Band	
18	VH8501A	Presetter P.C.B. Ass'y	HR-3300EG
–	VH8502A	Presetter P.C.B. Ass'y	HR-3300EK
19	DPSP3008Z	Screw	
20	A38172	Senser P.C.B. Bracket	Left Side
21	VH8001A	CH Selector P.C.B. Ass'y	HR-3300EG
–	VH8002A	CH Selector P.C.B. Ass'y	HR-3300EK
22	LPSP3006Z	Screw	
23	C40500	Tap Screw	
24	PU44611	Input Select Switch Ass'y	
25	A27437-1	Senser Panel	
26	C40500	Tap Screw	
27	C40534	Senser Knob	
28	LPSP3006Z	Screw	
29	C40627	Tap Screw	
30	LPSP3006ZS	Screw	
31	A27433	Senser P.C.B. Bracket	Right Side
32	LPSP3006Z	Screw	
33	PU30963	UHF Convertor	HR-3300EG
–	PU30962	UHF Convertor	HR-3300EK
34	PU44754	RF Holder (2)	
35	LPSP3006ZS	Screw	
36	DPSP3008ZS	Screw	
37	SBSB3006Z	Tap Screw	
38	PU45448A	Delay Equalizer P.C.B.	
39	PU45516	Spacer	
40	DPSP3006ZS	Screw	
41	DPSP3008ZS	Screw	
42	PU44613	Power Switch P.C.B. Ass'y	
43	EM6531FS	UHF Tuner	HR-3300EG
–	EM6530FS	UHF Tuner	HR-3300EK
44	A27432	Switch Bracket	
45	PU46060-2	Antenna Switch P.C.B. Ass'y	
46	C40540	Bracket	
47	C40500	Tap Screw	
48	C40500	Tap Screw	
49	C40606	Bracket	
50	VH1001A	Tuner P.C.B. Ass'y	HR-3300EG
–	VH1002A	Tuner P.C.B. Ass'y	HR-3300EK
51	C40627	Tap Screw	
52	LPSP3006ZS	Screw	
53	PU44751	Lamp Bush	
54	LPSP3006ZS	Screw	
55	LPSP3006ZS	Screw	
56	MH9301	Terminal Bracket Ass'y	
57	LPSP3008ZS	Screw	
58	PU41624-6	Insulator	
59	2SD3890	Transistor	
60	PU45375-1	Spacer	
61	LPSP3006ZS	Screw	
62	PU31305-2	Heat Sink	
63	LPSP3006ZS	Screw	
64	PU44753	Bracket	
65	DPSP3006ZS	Screw	
66	PU44741	Power Transistor P.C.B.	
67	LPSP3008ZS	Screw	
68	PU41624-6	Insulator	
69	LPSP3006ZS	Screw	
70	C40500	Tap Screw	

9-8 CABINET ASSEMBLY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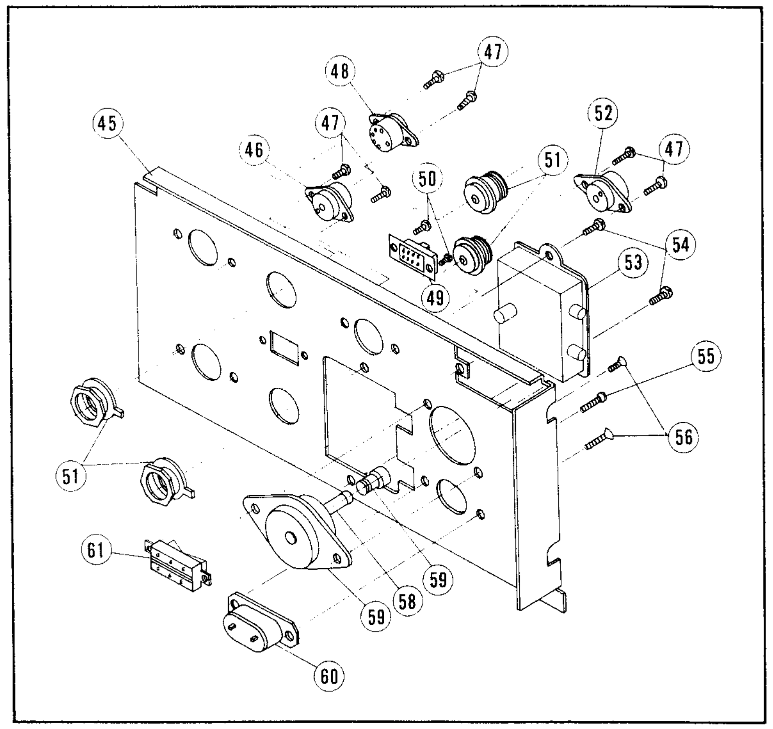
Connector panel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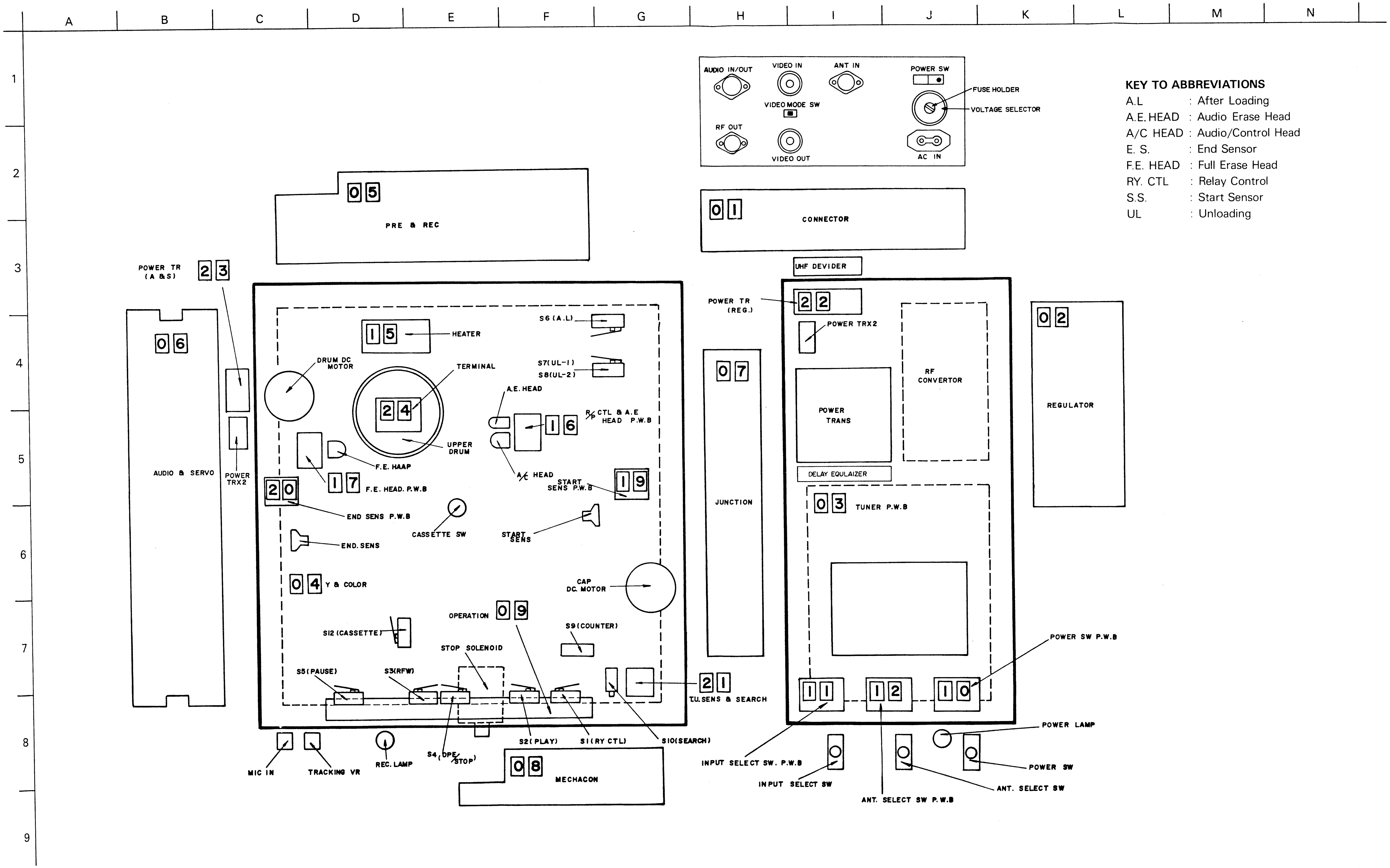
Symbol No.	Part No.	Part Name	Remarks
1	PU10129A	Top Panel	
2	PU45509	Shade	
3	SDBP3006BS	Screw	
4	PU10095	Bottom Cover	
5	PU44756	Foot	
6	LPSP3010ZS	Screw	
7	–	–	
8	WBS3000N	Lock Washer	
9	DPSP3006ZS	Screw	
10	PUS31290	Side Plate	
11	PUS45958-0E	Side Plate	
12	–	–	
13	PU44733	Washer	
14	SDBP3014RS	Screw	
15	PU10119A	Front Cover Ass'y	HR-3300EG
	PU10119B	Front Cover Ass'y	HR-3300EK
16	PU46000	Side Fitting	
17	SDSA3008Z	Tapping Screw	
18	PU44731	Knob (1)	
19	PU30080-50	Spring	
20	PU44758	Knob (2)	
21	DPSP3006ZS	Screw	
22	PU46141	Mark Ass'y	
23	PU45392	Seat (3)	
24	DPSP3008ZS	Screw	
25	PUS35863-0F	Timer	
26	PU43892	Knob	for Tracking Control
27	PU45998	Mic Panel	
28	A38190	Senser Plate	
29	PU44732	Knob	
30	PU31599	–	
31	A38192	Connector Panel	
32	SDBP3006BS	Screw	
33	PUS35688-0F	Rear Cover Ass'y	
34	–	–	
35	PU44888-2	Foot	
36	SDBP3010BS	Screw	
37	SDBP3006BS	Screw	
38	PU31054-58	Serial Number Plate	HR-3300EG
	PU31054-59	Serial Number Plate	HR-3300EK
39	PU42075	Caution Sticker	
40	PU31291B	Cassette Cover Ass'y	
41	PU45968	Label	
42	SDSA3008B	Tapping Screw	
43	–	–	
44	PU46070	RF Sticker	
45	A27438A	Terminal Bracket	
46	PU46471	Aerial Connector	HR-3300EG
	PU43252	Aerial Connector	HR-3300EK
47	LPSP3006Z	Screw	
48	QMC0589-001	5P DIN Connector	
49	AX49197	B & W Selector Switch	
50	SPSP2004Z	Screw	
51	GU45073-2	UHF Type Connector	
52	PU43252	Aerial Connector	
53	PU46415A	Booster Ass'y	(with Ant Separator)

Symbol No.	Part No.	Part Name	Remarks
54	C40500	Tap Screw	
55	LPSP3008Z	Screw	
56	SSSP3008ZS	Screw	
57	–	–	
58	QMF51A2-1R0	Fuse	1.0 A
59	PU45383	Voltage Selector	
60	AX49195	AC Inlet	
61	AX49196	Power Switch	

SECTION 10
CHARTS AND DIAGRAMS

10-1 ELECTRICAL PARTS LOCATION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AUDIO IN/OUT
VIDEO IN
ANT IN
POWER SW
FUSE HOLDER
VIDEO MODE SW
VOLTAGE SELECTOR
RF OUT
VIDEO OUT
AC IN
05
PRE & REC
01
CONNECTOR
POWER TR (A &S)
23
UHF DEVIDER
POWER TR (REG.)
22
POWER TRX2
02
06
15
HEATER
S6 (A.L)
DRUM DC MOTOR
TERMINAL
S7(UL-1)
S8(UL-2)
07
RF CONVERTOR
REGULATOR
A.E. HEAD
24
R/P CTL & A.E HEAD P.W.B
16
POWER TRANS
UPPER DRUM
F.E. HAAP
A/C HEAD
START SENS P.W.B
19
DELAY EQUALAIZER
AUDIO & SERVO
POWER TRX2
20
17
F.E. HEAD. P.W.B
JUNCTION
03
TUNER P.W.B
END SENS P.W.B
CASSETTE SW
START SENS
END. SENS
04
Y & COLOR
CAP DC. MOTOR
OPERATION
09
S9(COUNTER)
S12 (CASSETTE)
STOP SOLENOID
POWER SW P.W.B
S5(PAUSE)
S3(RFW)
21
T.U. SENS & SEARCH
11
12
10
POWER LAMP
S2(PLAY)
S1(RY CTL)
S10(SEARCH)
MIC IN
TRACKING VR
REC. LAMP
S4(OPE/STOP)
08
MECHACON
INPUT SELECT SW. P.W.B
INPUT SELECT SW
ANT. SELECT SW P.W.B
ANT. SELECT SW
POWER SW

KEY TO ABBREVIATIONS

A.L	: After Loading
A.E. HEAD	: Audio Erase Head
A/C HEAD	: Audio/Control Head
E. S.	: End Sensor
F.E. HEAD	: Full Erase Head
RY. CTL	: Relay Control
S.S.	: Start Sensor
UL	: Unloading

10-2 OVERALL WIRING

Key to abbreviations

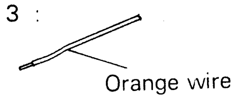
A	:	Audio
A.E. HEAD	:	Audio Erase Head
A.L.	:	After Loading
CAP.	:	Capstan
COL.	:	Color
CTL.	:	Control
D.	:	Drum
DL. EQ	:	Delay Equalizer
D.P. HEAD	:	Drum Pulse Head
E.S.	:	End Sensor
F.E. HEAD	:	Full Erase Head
F.F.	:	Flip-Flop
G.	:	Ground
P.B.	:	Playback
R/P HEAD	:	Record/Playback Head
RY. CTL.	:	Relay Control
SEL.	:	Select
SOL.	:	Solenoid
S.S.	:	Start Sensor
TR	:	Transistor
T.U. S.	:	Take-Up Sensor
UL.	:	Unloading
V	:	Video

Color Code

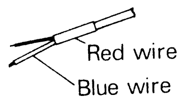
0	Black
1	Brown
2	Red
3	Orange
4	Yellow
5	Green
6	Blue
7	Violet
8	Gray
9	White

Color Code

3 :

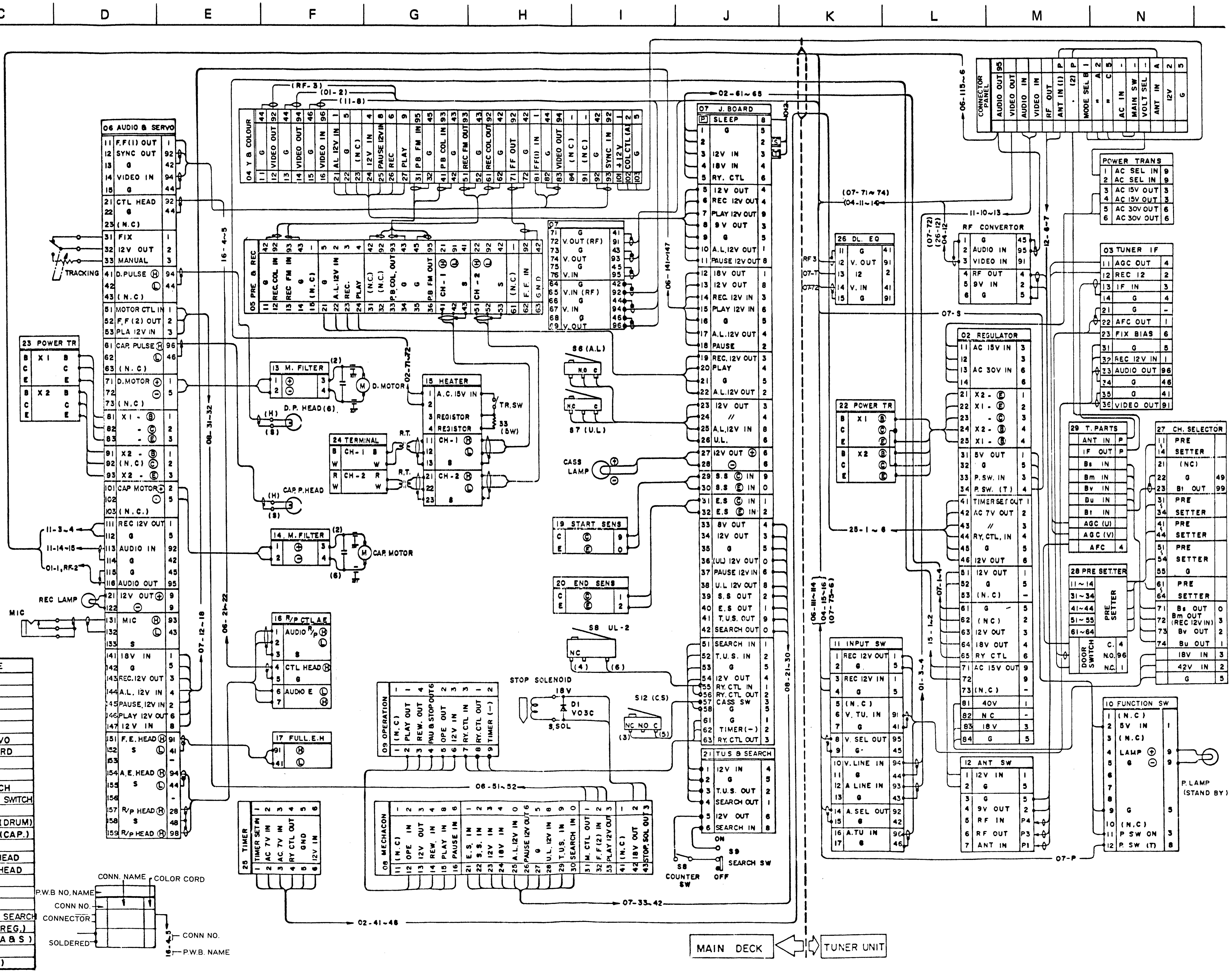

Orange wire

26 :


Red wire
Blue wire

P.W.B LIST

No.	P.W.B. NAME
0 1	CONNECTOR
0 2	REGULATOR
0 3	TUNER P.W.B
0 4	Y & COLOR
0 5	PRE & REC.
0 6	AUDIO & SERVO
0 7	JUNCTION BOARD
0 8	MECHACON
0 9	OPERATION
1 0	POWER SWITCH
1 1	INPUT SELECT SWITCH
1 2	ANT SWITCH
1 3	MOTOR FILTER (DRUM)
1 4	〃 〃 (CAP.)
1 5	HEATER
1 6	R/P CTL. A.E. HEAD
1 7	FULL ERASE HEAD
1 8	
1 9	START SENS
2 0	END SENS
2 1	TAKE UP SENS & SEARCH
2 2	POWER TR. (REG.)
2 3	〃 〃 (A & S)
2 4	TERMINAL
2 5	TIMER (Option)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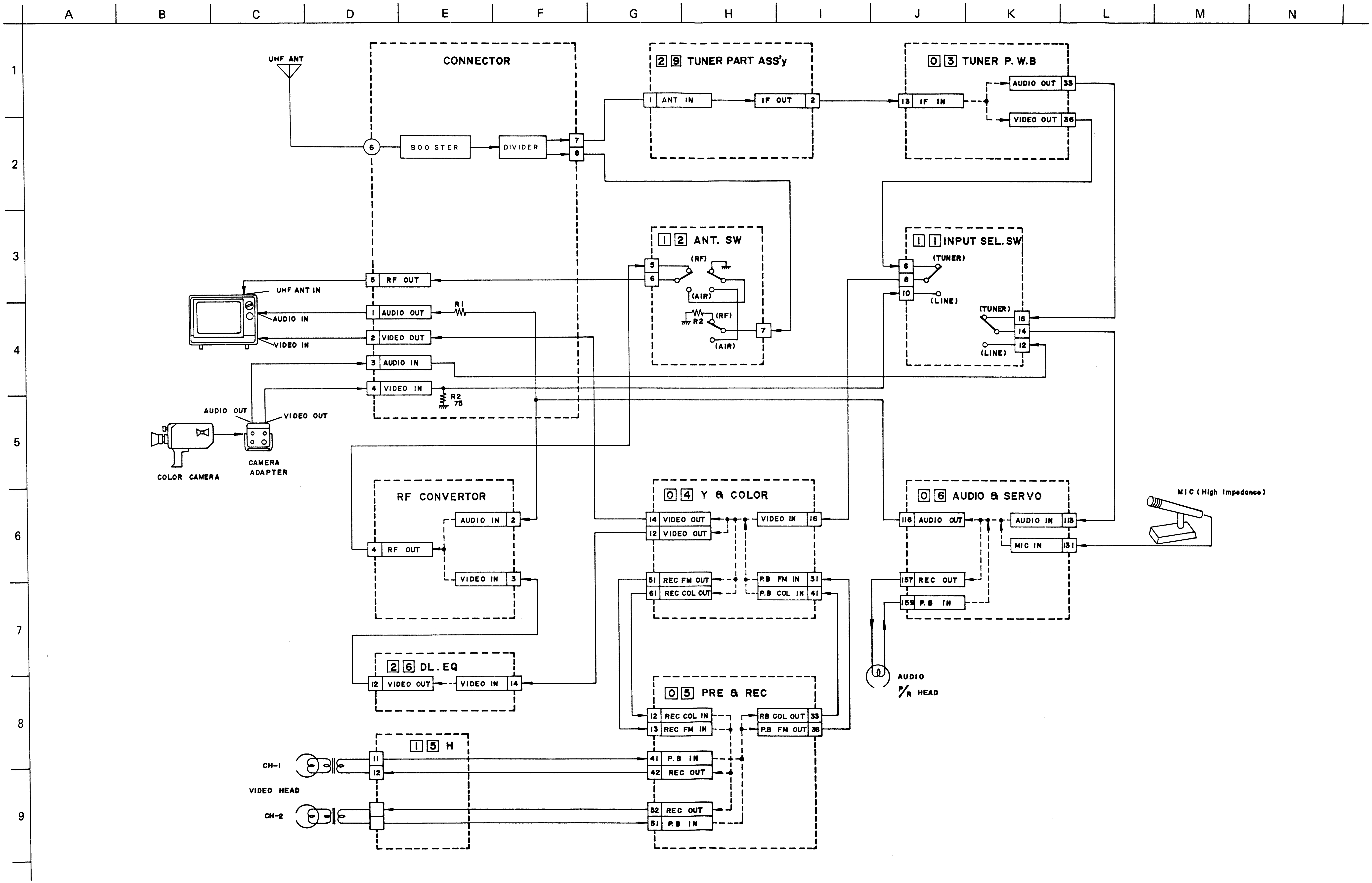
06 AUDIO & SERVO
04 Y & COLOUR
05 PRE & REC
07 J. BOARD
01 CONNECTOR PANEL
POWER TRANS
RF CONVERTOR
03 TUNER IF
26 DL. EQ
02 REGULATOR
22 POWER TR
23 POWER TR
13 M. FILTER
14 M. FILTER
15 HEATER
24 TERMINAL
16 R/P CTL.A.E.
17 FULL.E.H
19 START SENS
20 END SENS
21 T.U.S & SEARCH
09 OPERATION
08 MECHACON
25 TIMER
11 INPUT SW
12 ANT SW
10 FUNCTION SW
29 T. PARTS
27 CH. SELECTOR
28 PRE SETTER
D. MOTOR
CAP. MOTOR
D.P. HEAD (6)
CAP. P. HEAD
TRACKING
REC LAMP
MIC
CASS LAMP
TR. SW
S6 (A.L)
S7 (U.L)
S8 UL-2
STOP SOLENOID
S12 (CS)
S8 COUNTER SW
S9 SEARCH SW
P. LAMP (STAND BY)
DOOR SWITCH
CONN. NAME
COLOR CORD
P.W.B NO. NAME
CONN NO.
CONNECTOR
SOLDERED
CONN NO.
P.W.B. NAME
MAIN DECK
TUNER UNIT

10-3 SIGNAL LINE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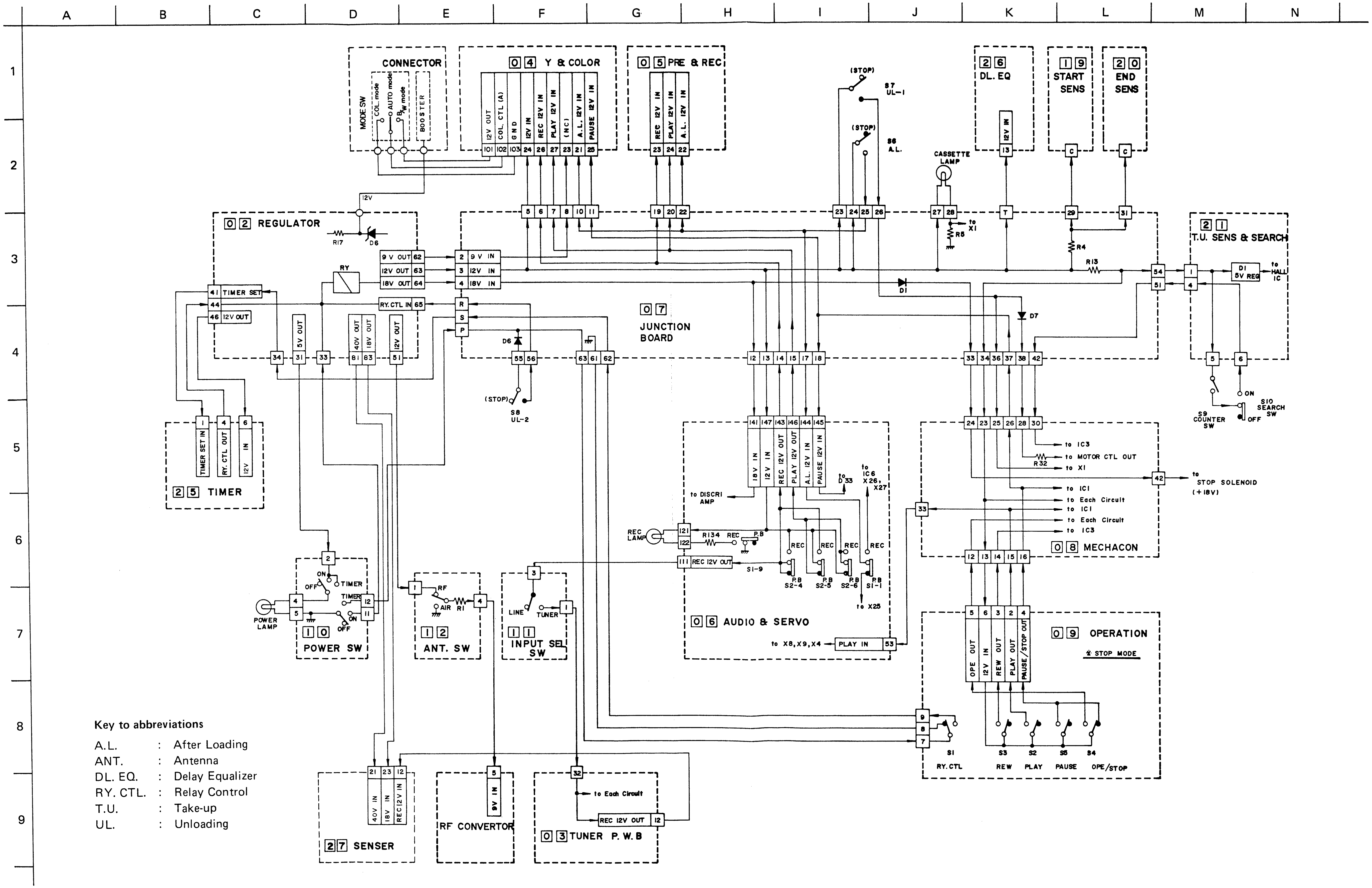
9
UHF ANT
CONNECTOR
6
BOO STER
DIVIDER
7
6
5 RF OUT
1 AUDIO OUT
2 VIDEO OUT
3 AUDIO IN
4 VIDEO IN
R1
R2 75
2 9 TUNER PART ASS'y
1 ANT IN
IF OUT 2
0 3 TUNER P. W.B
13 IF IN
AUDIO OUT 33
VIDEO OUT 36
1 2 ANT. SW
(RF)
(AIR)
R2
(RF)
(AIR)
5
6
7
1 1 INPUT SEL. SW
(TUNER)
(LINE)
(TUNER)
(LINE)
6
8
10
16
14
12
UHF ANT IN
AUDIO IN
VIDEO IN
AUDIO OUT
VIDEO OUT
COLOR CAMERA
CAMERA ADAPTER
RF CONVERTOR
AUDIO IN 2
4 RF OUT
VIDEO IN 3
0 4 Y & COLOR
14 VIDEO OUT
12 VIDEO OUT
VIDEO IN 16
51 REC FM OUT
61 REC COL OUT
P.B FM IN 31
P.B COL IN 41
0 6 AUDIO & SERVO
116 AUDIO OUT
AUDIO IN 113
MIC IN 131
157 REC OUT
159 P.B IN
MIC (High Impedance)
AUDIO P/R HEAD
2 6 DL. EQ
12 VIDEO OUT
VIDEO IN 14
0 5 PRE & REC
12 REC COL IN
13 REC FM IN
P.B COL OUT 33
P.B FM OUT 36
41 P.B IN
42 REC OUT
52 REC OUT
51 P.B IN
1 5 H
11
12
CH-1
VIDEO HEAD
CH-2

10-4 B + LINE

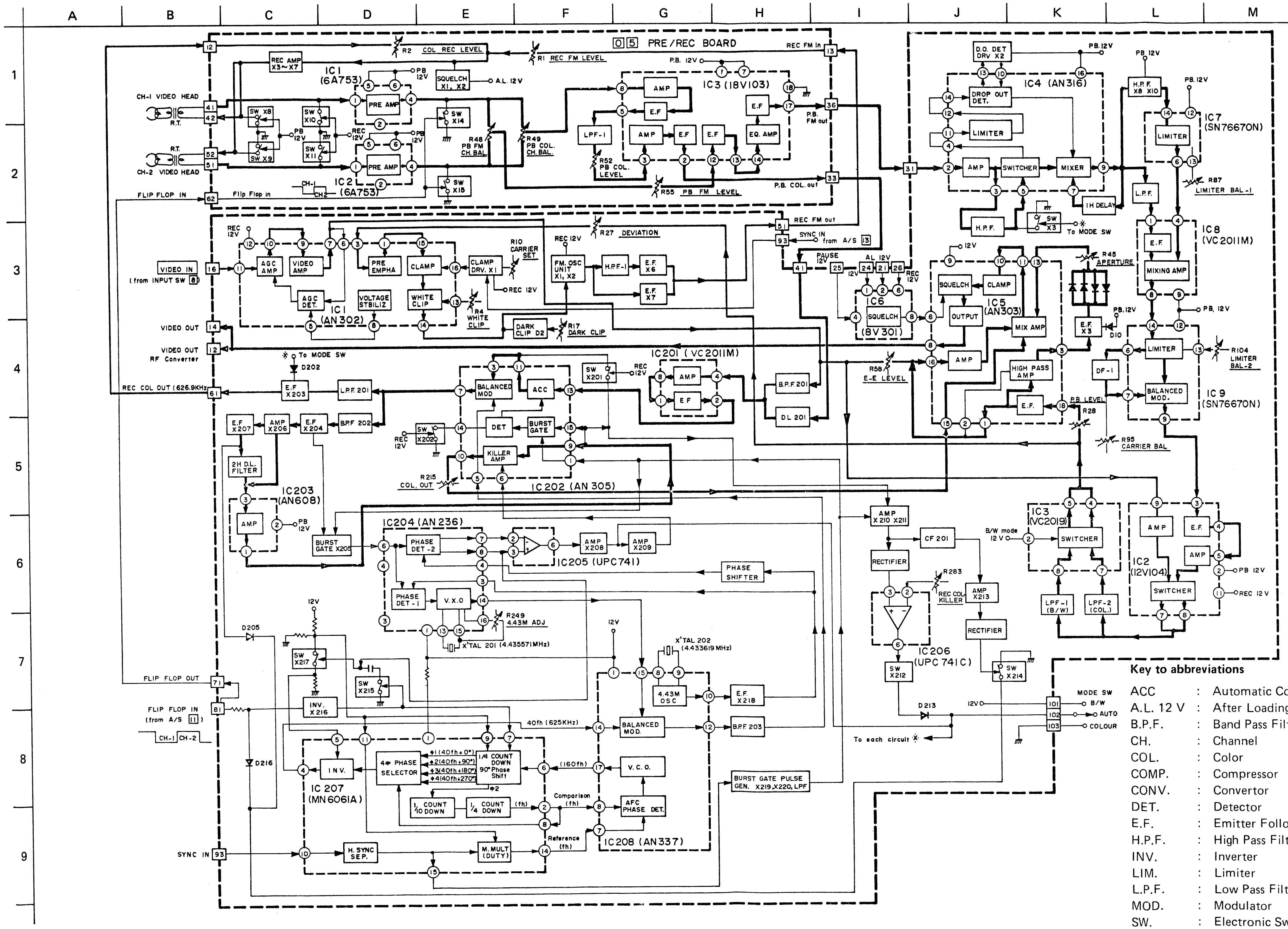


A B C D E F G H I J K L M N
1 2 3 4 5 6 7 8 9
CONNECTOR
MODE SW
COL. mode
AUTO mode
B/W mode
BOOSTER
04 Y & COLOR
12V OUT
COL. CTL (A)
GND
REC 12V IN
PLAY 12V IN
(NC)
A.L. 12V IN
PAUSE 12V IN
05 PRE & REC
REC 12V IN
PLAY 12V IN
A.L. 12V IN
(STOP)
S7 UL-1
S6 A.L.
CASSETTE LAMP
26 DL. EQ
12V IN
19 START SENS
20 END SENS
02 REGULATOR
R17
D6
9 V OUT 62
12V OUT 63
18V OUT 64
RY
RY. CTL IN 65
41 TIMER SET
44
46 12V OUT
5V OUT
40V OUT
18V OUT
12V OUT
9 V IN
12V IN
18V IN
to X1
R5
R4
R13
D1
D7
21 T.U. SENS & SEARCH
D1 5V REG
to HALL IC
07 JUNCTION BOARD
(STOP)
S8 UL-2
S9 COUNTER SW
S10 SEARCH SW
ON
OFF
25 TIMER
TIMER SET IN
RY. CTL OUT
12V IN
06 AUDIO & SERVO
18V IN
12V IN
REC 12V OUT
PLAY 12V IN
A.L. 12V IN
PAUSE 12V IN
to DISCRI AMP
to D33
to IC6 X26, X27
REC LAMP
R134
REC
P.B
REC 12V OUT
S1-9
S2-4
S2-5
S2-6
S1-1
to X25
to X8, X9, X4
PLAY IN
08 MECHACON
to IC3
to MOTOR CTL OUT
R32
to X1
to IC1
to Each Circuit
to STOP SOLENOID (+18V)
09 OPERATION
※ STOP MODE
OPE OUT
12V IN
REW OUT
PLAY OUT
PAUSE/STOP OUT
S1 RY. CTL
S3 REW
S2 PLAY
S5 PAUSE
S4 OPE/STOP
10 POWER SW
ON
OFF
TIMER
POWER LAMP
12 ANT. SW
RF
AIR
R1
11 INPUT SEL SW
LINE
TUNER
27 SENSER
40V IN
18V IN
REC 12V IN
RF CONVERTOR
9V IN
03 TUNER P.W.B
to Each Circuit
REC 12V OUT

Key to abbreviations

A.L. : After Loading
ANT. : Antenna
DL. EQ. : Delay Equalizer
RY. CTL. : Relay Control
T.U. : Take-up
UL. : Unloading

VIDEO SYSTEM BLOCK DIAGRAM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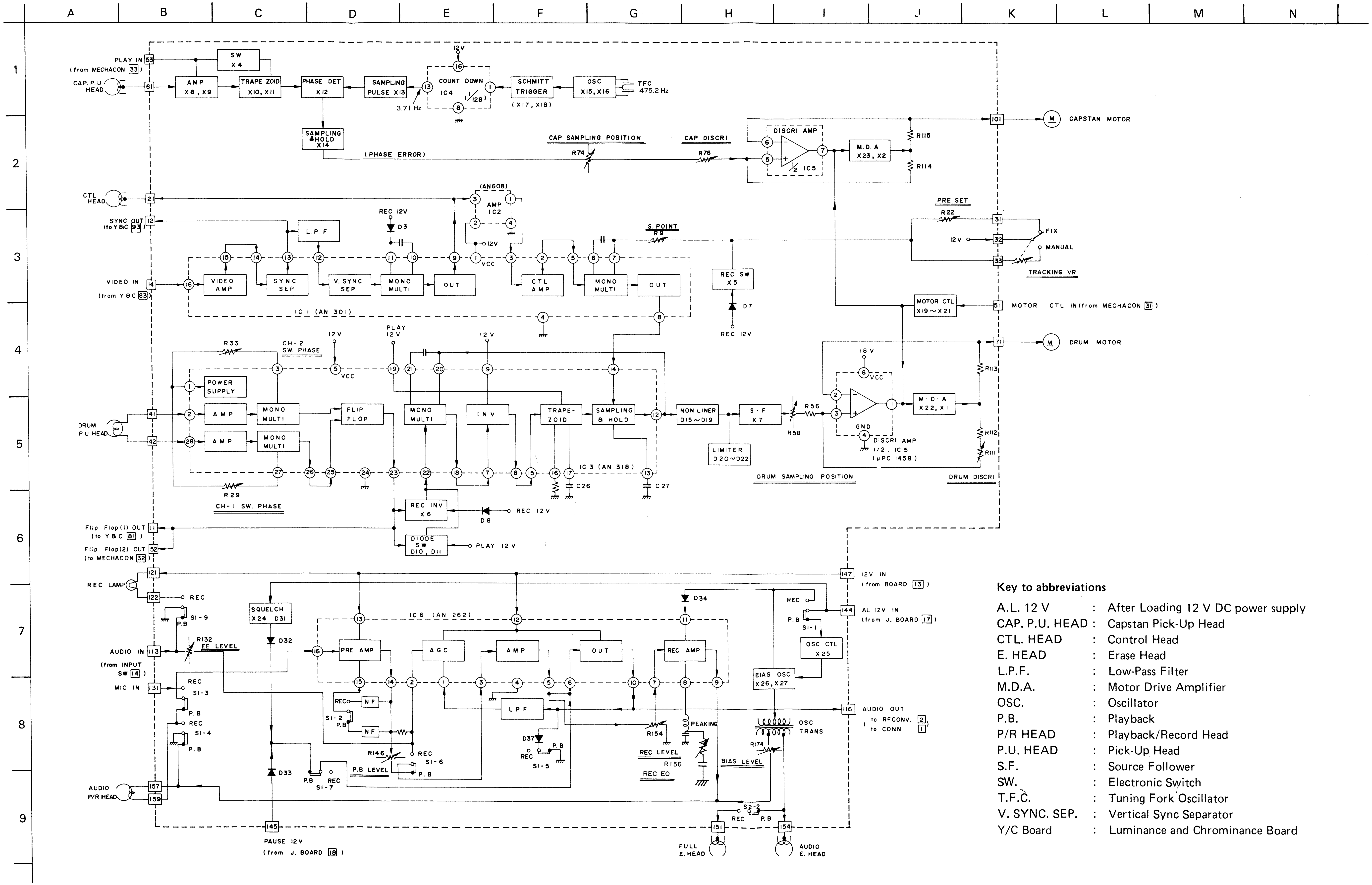
05 PRE/REC BOARD
CH-1 VIDEO HEAD
CH-2 VIDEO HEAD
R.T.
FLIP FLOP IN
Flip Flop in
REC AMP X3~X7
IC1 (6A753)
IC2 (6A753)
PRE AMP
SQUELCH X1, X2
A.L. 12V
SW X8
SW X9
SW X10
SW X11
SW X14
SW X15
R2 COL REC LEVEL
R1 REC FM LEVEL
REC FM in
P.B. 12V
IC3 (18V103)
AMP
E.F
LPF-1
EQ. AMP
R48 PB FM CH. BAL.
R49 PB COL. CH. BAL.
R52 PB COL. LEVEL
R55 PB FM LEVEL
P.B. FM out
P.B. COL. out
CH-1
CH-2
R27 DEVIATION
REC FM out
SYNC IN from A/S 13
PAUSE 12V
AL 12V
VIDEO IN (from INPUT SW 8)
AGC AMP
VIDEO AMP
AGC DET.
PRE EMPHA
CLAMP
CLAMP DRV. X1
VOLTAGE STBILIZ
WHITE CLIP
IC1 (AN302)
R10 CARRIER SET
REC 12V
FM. OSC UNIT X1, X2
H.P.F-1
E.F X6
E.F X7
R4 WHITE CLIP
DARK CLIP D2
R17 DARK CLIP
VIDEO OUT
VIDEO OUT RF Converter
To MODE SW
D202
REC COL OUT (626.9KHz)
E.F X203
LPF 201
BPF 202
E.F X204
AMP X206
E.F X207
2H D.L. FILTER
IC203 (AN608)
BURST GATE X205
IC201 (VC2011M)
BALANCED MOD
ACC
DET
BURST GATE
KILLER AMP
SW X201
SW X202
R215 COL. OUT
IC202 (AN305)
B.P.F 201
DL 201
IC204 (AN236)
PHASE DET-2
PHASE DET-1
V.X.O
R249 4.43M ADJ
X'TAL 201 (4.433571MHz)
IC205 (UPC741)
AMP X208
AMP X209
PHASE SHIFTER
X'TAL 202 (4.433619 MHz)
4.43M OSC
E.F X218
BALANCED MOD.
B.P.F 203
40fh (625KHz)
D205
D216
SW X217
SW X215
INV. X216
FLIP FLOP OUT
FLIP FLOP IN (from A/S 11)
SYNC IN
IC 207 (MN6061A)
INV.
4ϕ PHASE SELECTOR
ϕ1 (40fh+0°)
ϕ2 (40fh+90°)
ϕ3 (40fh+180°)
ϕ4 (40fh+270°)
1/4 COUNT DOWN 90° Phase Shift
1/10 COUNT DOWN
1/4 COUNT DOWN
(160fh)
Comparison (fh)
Reference (fh)
V.C.O.
AFC PHASE DET.
IC208 (AN337)
H. SYNC SEP.
M. MULT (DUTY)
BURST GATE PULSE GEN. X219, X220, LPF
D.O. DET DRV X2
IC4 (AN316)
DROP OUT DET.
LIMITER
SWITCHER
MIXER
1H DELAY
H.P.F.
SW X3
To MODE SW
H.P.F X8 X10
IC7 (SN76670N)
R87 LIMITER BAL-1
L.P.F.
IC8 (VC2011M)
MIXING AMP
R45 APERTURE
IC6 (8V301)
SQUELCH
IC5 (AN303)
OUTPUT
MIX AMP
E.F. X3
D10
R58 E-E LEVEL
HIGH PASS AMP
E.F.
PB LEVEL R28
DF-1
BALANCED MOD.
IC9 (SN76670N)
R104 LIMITER BAL-2
R95 CARRIER BAL
AMP X210 X211
CF 201
RECTIFIER
R283 REC COL KILLER
AMP X213
IC206 (UPC741C)
SW X212
SW X214
D213
To each circuit
B/W mode 12V
IC3 (VC2019)
LPF-1 (B/W)
LPF-2 (COL.)
IC2 (12V104)
PB 12V
REC 12V
MODE SW
B/W
AUTO
COLOUR

Key to abbreviations

ACC : Automatic Color Control
A.L. 12 V : After Loading power supply (12 V)
B.P.F. : Band Pass Filter
CH. : Channel
COL. : Color
COMP. : Compressor
CONV. : Convertor
DET. : Detector
E.F. : Emitter Follower
H.P.F. : High Pass Filter
INV. : Inverter
LIM. : Limiter
L.P.F. : Low Pass Filter
MOD. : Modulator
SW. : Electronic Switch
V.X.O. : Variable Crystal Oscillator

10-6 AUDIO AND SERVO BLOCK DIAGRAM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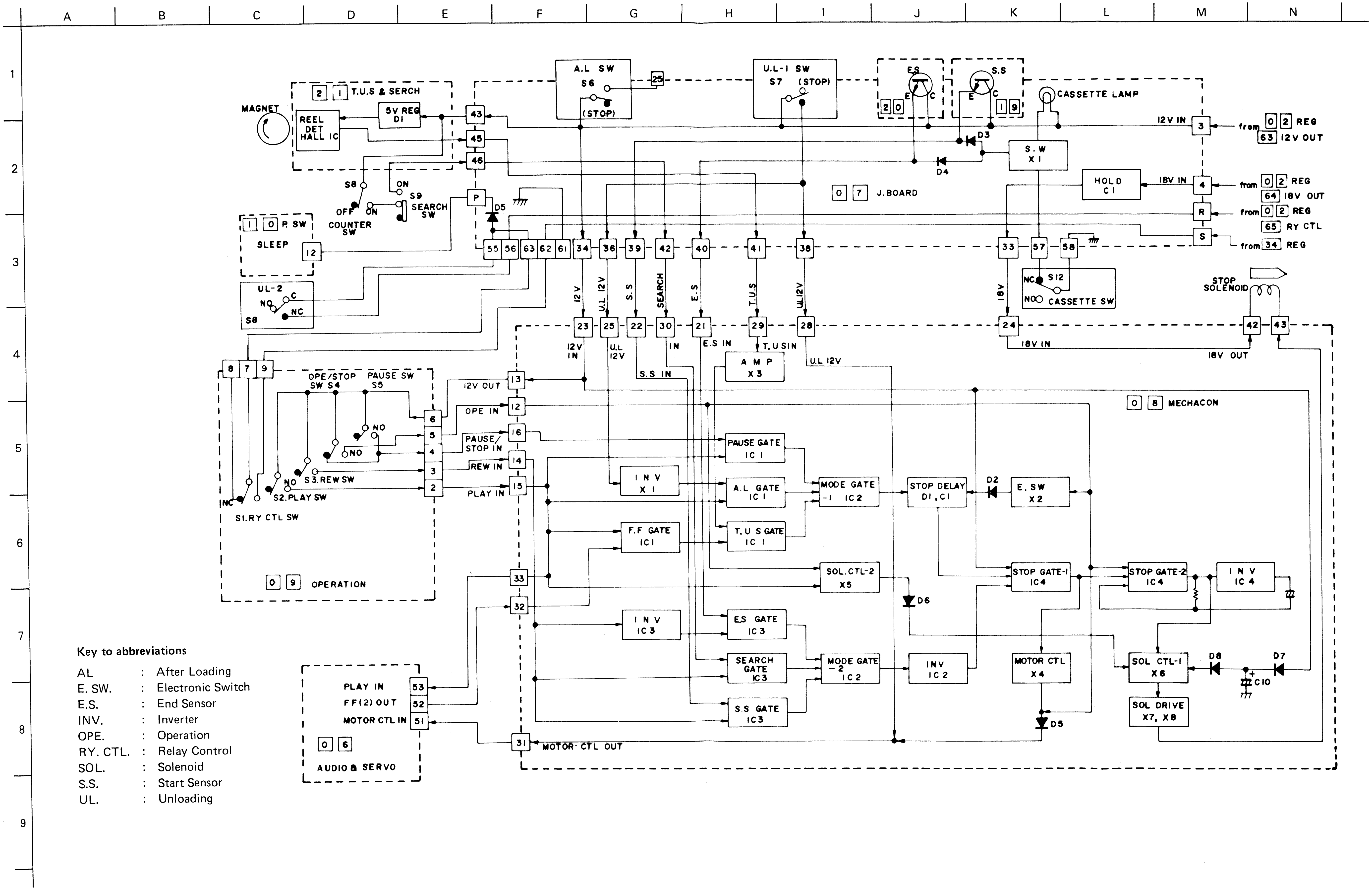
9
PLAY IN 53 (from MECHACON 33)
CAP. P.U HEAD
61
SW X4
AMP X8, X9
TRAPE ZOID X10, X11
PHASE DET X12
SAMPLING PULSE X13
12V
16
COUNT DOWN IC4 1/128
13
1
8
3.71 Hz
SCHMITT TRIGGER (X17, X18)
OSC X15, X16
TFC 475.2 Hz
SAMPLING &HOLD X14
(PHASE ERROR)
CAP SAMPLING POSITION
R74
CAP DISCRI
R76
DISCRI AMP
1/2 IC5
M.D.A X23, X2
R115
R114
101
CAPSTAN MOTOR
CTL HEAD
21
(AN608)
AMP IC2
SYNC OUT 12 (to Y&C 93)
L.P.F
REC 12V
D3
12V
VCC
S. POINT R9
PRE SET R22
31
32
33
FIX
MANUAL
TRACKING VR
VIDEO IN 14 (from Y&C 83)
VIDEO AMP
SYNC SEP
V. SYNC SEP
MONO MULTI
OUT
CTL AMP
MONO MULTI
OUT
IC1 (AN 301)
REC SW X5
D7
REC 12V
MOTOR CTL X19~X21
51
MOTOR CTL IN (from MECHACON 31)
71
DRUM MOTOR
R33
CH-2 SW. PHASE
12V
PLAY 12V
12V
18V
POWER SUPPLY
AMP
MONO MULTI
FLIP FLOP
MONO MULTI
INV
TRAPE-ZOID
SAMPLING & HOLD
NON LINER D15~D19
S·F X7
R56
R58
LIMITER D20~D22
M·D·A X22, X1
R113
R112
R111
GND
DISCRI AMP 1/2 IC5 (μPC 1458)
DRUM P.U HEAD
41
42
AMP
MONO MULTI
R29
CH-1 SW. PHASE
IC3 (AN 318)
C26
C27
DRUM SAMPLING POSITION
DRUM DISCRI
REC INV X6
D8
REC 12V
DIODE SW D10, D11
PLAY 12V
Flip Flop(1) OUT 11 (to Y&C 81)
Flip Flop(2) OUT 52 (to MECHACON 32)
REC LAMP
121
122
REC
S1-9
P.B
147
12V IN (from BOARD 13)
144
AL 12V IN (from J. BOARD 17)
SQUELCH X24 D31
D32
D34
IC6 (AN 262)
REC
P.B
S1-1
R132 EE LEVEL
AUDIO IN 113 (from INPUT SW 14)
PRE AMP
AGC
AMP
OUT
REC AMP
OSC CTL X25
BIAS OSC X26, X27
MIC IN 131
REC
S1-3
P.B
REC
S1-4
P.B
NF
NF
S1-2
P.B
LPF
D37
S1-5
R154
PEAKING
REC LEVEL
R156
REC EQ
116
AUDIO OUT (to RFCONV. 2, to CONN 1)
OSC TRANS
R174
BIAS LEVEL
R146
S1-6
P.B LEVEL
P.B
REC
S1-7
D33
AUDIO P/R HEAD
157
159
S2-2
REC
P.B
145
PAUSE 12V (from J. BOARD 18)
151
154
FULL E. HEAD
AUDIO E. HEAD

Key to abbreviations

A.L. 12 V	:	After Loading 12 V DC power supply
CAP. P.U. HEAD	:	Capstan Pick-Up Head
CTL. HEAD	:	Control Head
E. HEAD	:	Erase Head
L.P.F.	:	Low-Pass Filter
M.D.A.	:	Motor Drive Amplifier
OSC.	:	Oscillator
P.B.	:	Playback
P/R HEAD	:	Playback/Record Head
P.U. HEAD	:	Pick-Up Head
S.F.	:	Source Follower
SW.	:	Electronic Switch
T.F.C.	:	Tuning Fork Oscillator
V. SYNC. SEP.	:	Vertical Sync Separator
Y/C Board	:	Luminance and Chrominance Board

10-7 MECHANISM CONTROL CIRCUIT BLOCK DIAGRAM

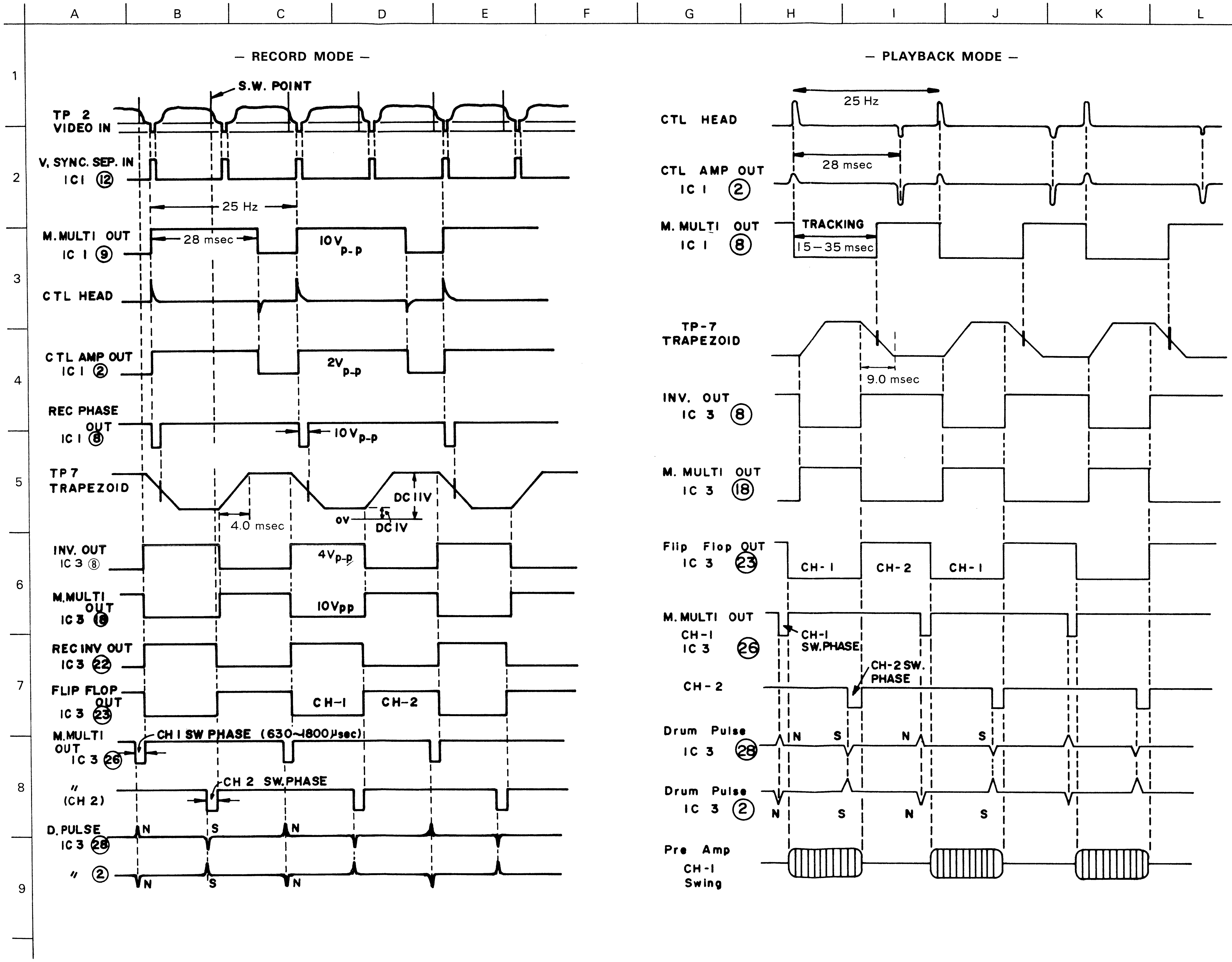


A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
MAGNET
2 1 T.U.S & SERCH
REEL DET HALL IC
5V REG D1
43
45
46
P
D5
S8
OFF ON
COUNTER SW
ON
S9
SEARCH SW
1 0 P. SW
SLEEP
12
UL-2
NO C NC
S8
A.L SW
S6
(STOP)
25
U.L-1 SW
S7 (STOP)
E.S
E C
2 0
S.S
E C
1 9
CASSETTE LAMP
12V IN
3
from 0 2 REG
63 12V OUT
D3
D4
S.W X1
HOLD C1
18V IN
4
from 0 2 REG
64 18V OUT
R
from 0 2 REG
65 RY CTL
S
from 34 REG
0 7 J.BOARD
55 56 63 62 61 34 36 39 42 40 41 38
33 57 58
NC S12
NO CASSETTE SW
18V
12V
U.L 12V
S.S
SEARCH
E.S
T.U.S
U.L 12V
STOP SOLENOID
23 25 22 30 21 29 28
24
42 43
12V IN
U.L 12V
S.S IN
IN
E.S IN
T.U.S IN
AMP X3
U.L 12V
18V IN
18V OUT
8 7 9
OPE/STOP SW S4
PAUSE SW S5
NO
NO
6
5
4
3
2
NO
S3.REW SW
S2.PLAY SW
NC
S1.RY CTL SW
0 9 OPERATION
13
12V OUT
12
OPE IN
16
PAUSE/STOP IN
14
REW IN
15
PLAY IN
0 8 MECHACON
PAUSE GATE IC1
INV X1
A.L GATE IC1
MODE GATE -1 IC2
STOP DELAY D1, C1
D2
E.SW X2
F.F GATE IC1
T.U S GATE IC1
SOL.CTL-2 X5
D6
STOP GATE-1 IC4
STOP GATE-2 IC4
INV IC4
33
32
INV IC3
E.S GATE IC3
SEARCH GATE IC3
MODE GATE -2 IC2
INV IC2
MOTOR CTL X4
SOL CTL-1 X6
D8
D7
C10
SOL DRIVE X7, X8
S.S GATE IC3
D5
PLAY IN 53
FF(2) OUT 52
MOTOR CTL IN 51
0 6
AUDIO & SERVO
31
MOTOR CTL OUT

Key to abbreviations

AL : After Loading
E. SW. : Electronic Switch
E.S. : End Sensor
INV. : Inverter
OPE. : Operation
RY. CTL. : Relay Control
SOL. : Solenoid
S.S. : Start Sensor
UL. : Unloading

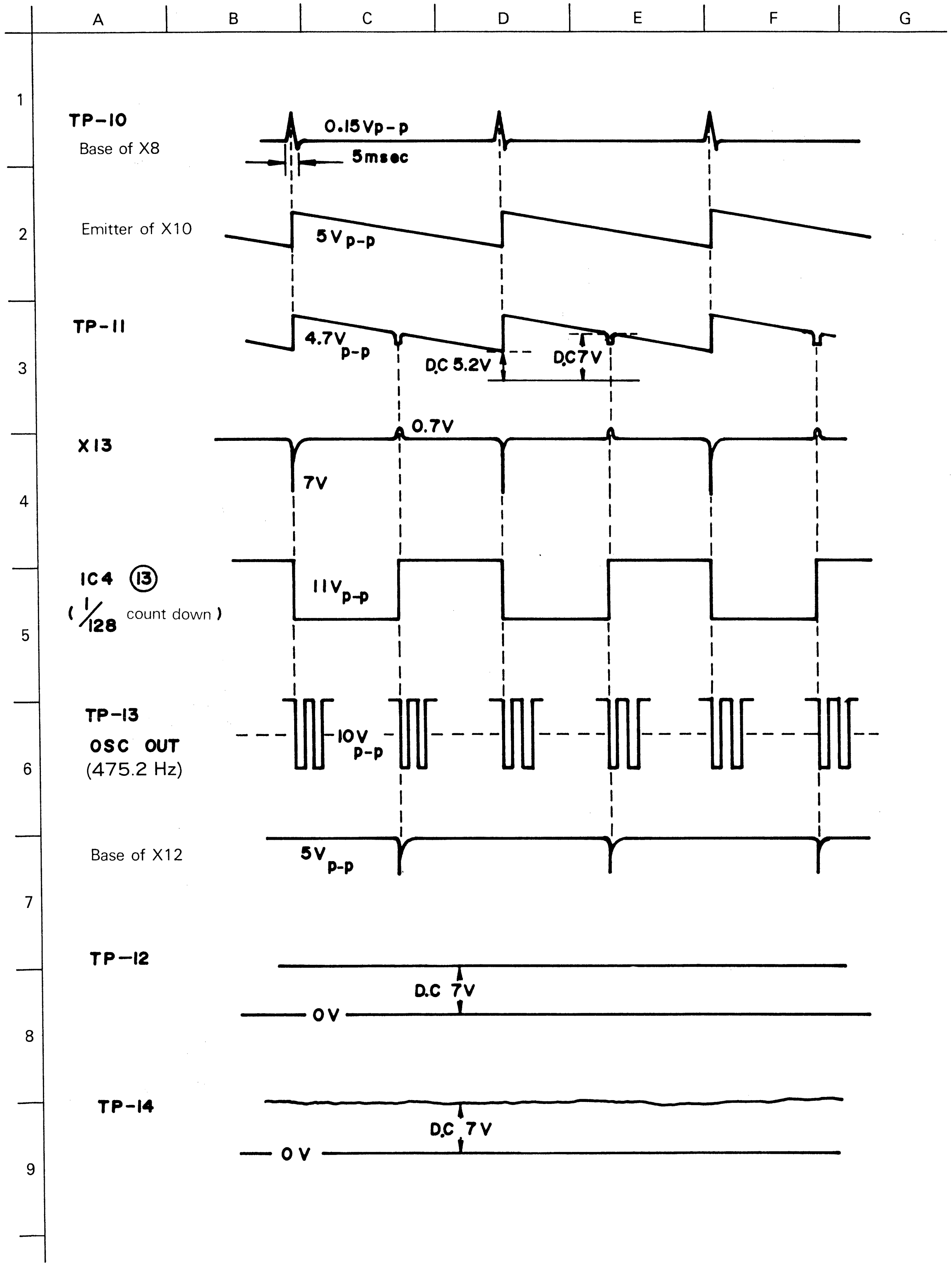
10-8 DRUM SERVO TIMING CHART


A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
– RECORD MODE –
S.W. POINT
TP 2
VIDEO IN
V. SYNC. SEP. IN
IC1 ⑫
25 Hz
M.MULTI OUT
IC 1 ⑨
28 msec
10V p-p
CTL HEAD
CTL AMP OUT
IC 1 ②
2V p-p
REC PHASE OUT
IC 1 ⑧
10V p-p
TP 7
TRAPEZOID
4.0 msec
0V
DC 11V
DC 1V
INV. OUT
IC 3 ⑧
4Vp-p
M.MULTI OUT
IC 3 ⑱
10Vpp
REC INV OUT
IC3 ㉒
FLIP FLOP OUT
IC 3 ㉓
CH-1
CH-2
M.MULTI OUT
IC 3 ㉖
CH 1 SW PHASE (630~1800μsec)
〃
(CH 2)
CH 2 SW.PHASE
D.PULSE
IC 3 ㉘
〃 ②
N
S
N
N
S
N
– PLAYBACK MODE –
CTL HEAD
25 Hz
CTL AMP OUT
IC 1 ②
28 msec
M. MULTI OUT
IC 1 ⑧
TRACKING
15–35 msec
TP-7
TRAPEZOID
9.0 msec
INV. OUT
IC 3 ⑧
M. MULTI OUT
IC 3 ⑱
Flip Flop OUT
IC 3 ㉓
CH-1
CH-2
CH-1
M.MULTI OUT
CH-1
IC 3 ㉖
CH-1
SW.PHASE
CH-2
CH-2 SW.
PHASE
Drum Pulse
IC 3 ㉘
N
S
N
S
Drum Pulse
IC 3 ②
N
S
N
S
Pre Amp
CH-1
Swing

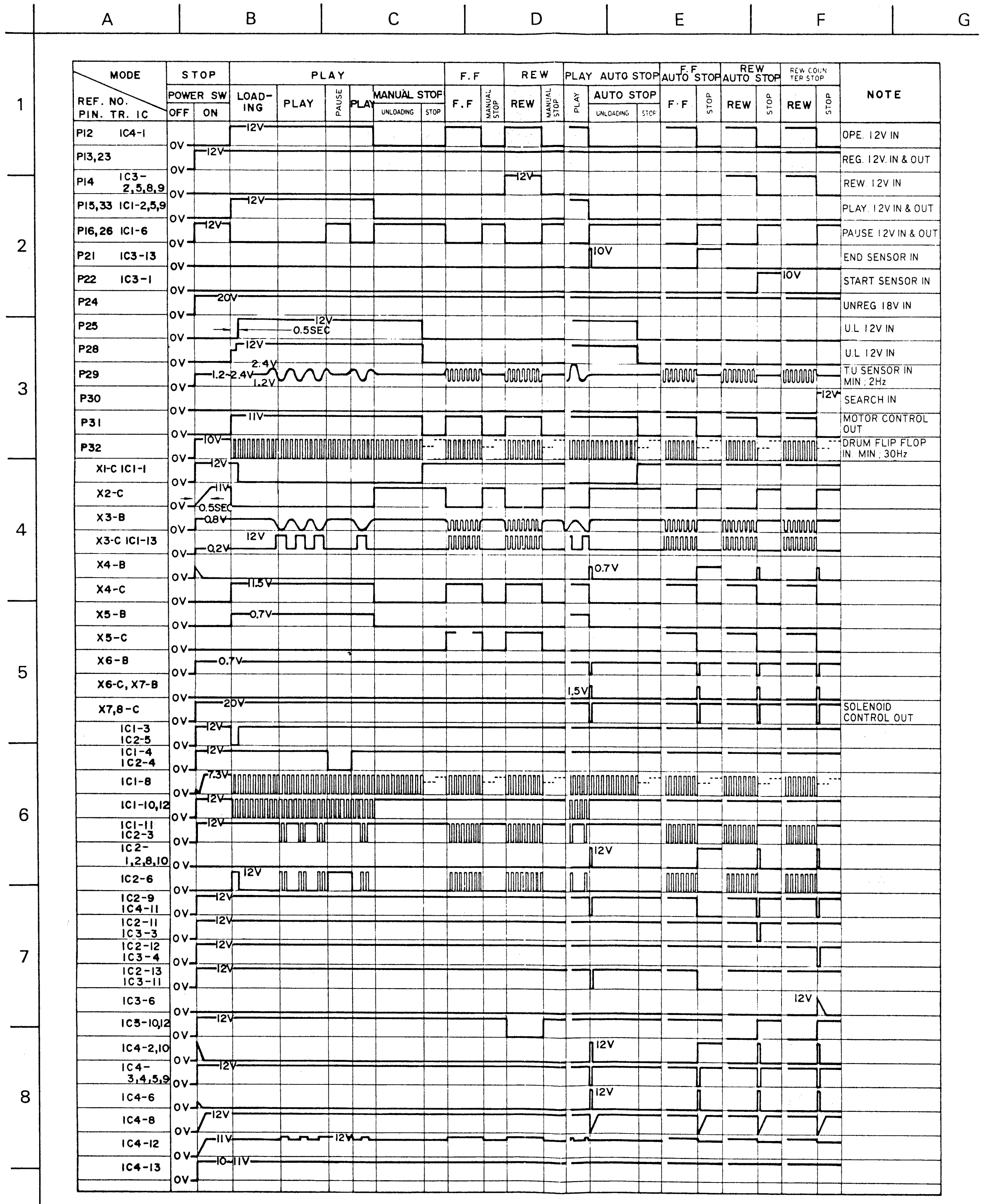
Key to abbreviations

CTL	:	Control
D. PULSE	:	Drum Pulse
INV.	:	Inverter
M. MULTI.	:	Monostable Multivibrator
P.B.	:	Playback
V. SYNC SEP.	:	Vertical Sync Separator

10-9 CAPSTAN SERVO TIMING CHART

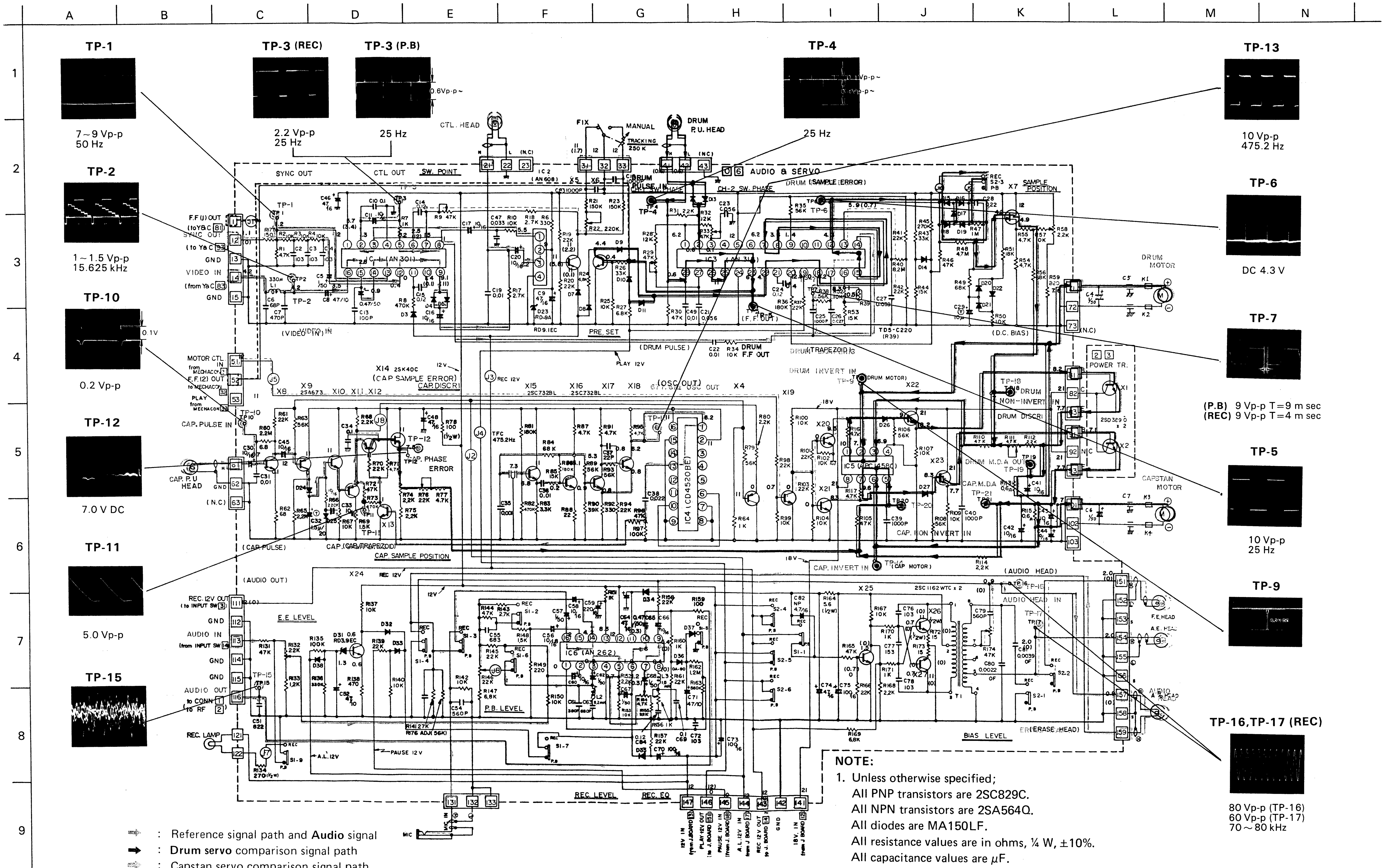

A
B
C
D
E
F
G
1
2
3
4
5
6
7
8
9
TP-10
Base of X8
0.15Vp-p
5msec
Emitter of X10
5Vp-p
TP-11
4.7Vp-p
D.C 5.2V
D.C 7V
X13
0.7V
7V
IC4 ⑬
(1/128 count down)
11Vp-p
TP-13
OSC OUT
(475.2 Hz)
10Vp-p
Base of X12
5Vp-p
TP-12
D.C 7V
0V
TP-14
D.C 7V
0 V

10-10 MECHANISM CONTROL CIRCUIT TIMING CHART


A
B
C
D
E
F
G
1
2
3
4
5
6
7
8
9
MODE
STOP
PLAY
F.F
REW
PLAY AUTO STOP
F.F AUTO STOP
REW AUTO STOP
REW COUNTER STOP
REF. NO.
PIN. TR. IC
POWER SW
OFF
ON
LOAD-ING
PLAY
PAUSE
PLAY
MANUAL STOP
UNLOADING
STOP
F.F
MANUAL STOP
REW
MANUAL STOP
PLAY
AUTO STOP
UNLOADING
STOP
F·F
STOP
REW
STOP
REW
STOP
NOTE
P12 IC4-1
P13,23
P14 IC3-2,5,8,9
P15,33 IC1-2,5,9
P16,26 IC1-6
P21 IC3-13
P22 IC3-1
P24
P25
P28
P29
P30
P31
P32
X1-C IC1-1
X2-C
X3-B
X3-C IC1-13
X4-B
X4-C
X5-B
X5-C
X6-B
X6-C, X7-B
X7,8-C
IC1-3 IC2-5
IC1-4 IC2-4
IC1-8
IC1-10,12
IC1-11 IC2-3
IC2-1,2,8,10
IC2-6
IC2-9 IC4-11
IC2-11 IC3-3
IC2-12 IC3-4
IC2-13 IC3-11
IC3-6
IC3-10,12
IC4-2,10
IC4-3,4,5,9
IC4-6
IC4-8
IC4-12
IC4-13
OV
12V
10V
20V
0.5SEC
2.4V
1.2-2.4V
1.2V
11V
0.8V
0.2V
0.7V
1.5V
7.3V
10-11V
OPE. 12V IN
REG. 12V IN & OUT
REW. 12V IN
PLAY 12V IN & OUT
PAUSE 12V IN & OUT
END SENSOR IN
START SENSOR IN
UNREG 18V IN
U.L 12V IN
U.L 12V IN
TU SENSOR IN MIN. 2Hz
SEARCH IN
MOTOR CONTROL OUT
DRUM FLIP FLOP IN MIN. 30Hz
SOLENOID CONTROL OUT

Key to abbreviations
F.F. : Fast Forward T. U : Take-up
OPE. : Operation U.L : Unloading

10-11 AUDIO AND SERVO (A/S) CIRCUIT SCHEMATIC DIAGRAM

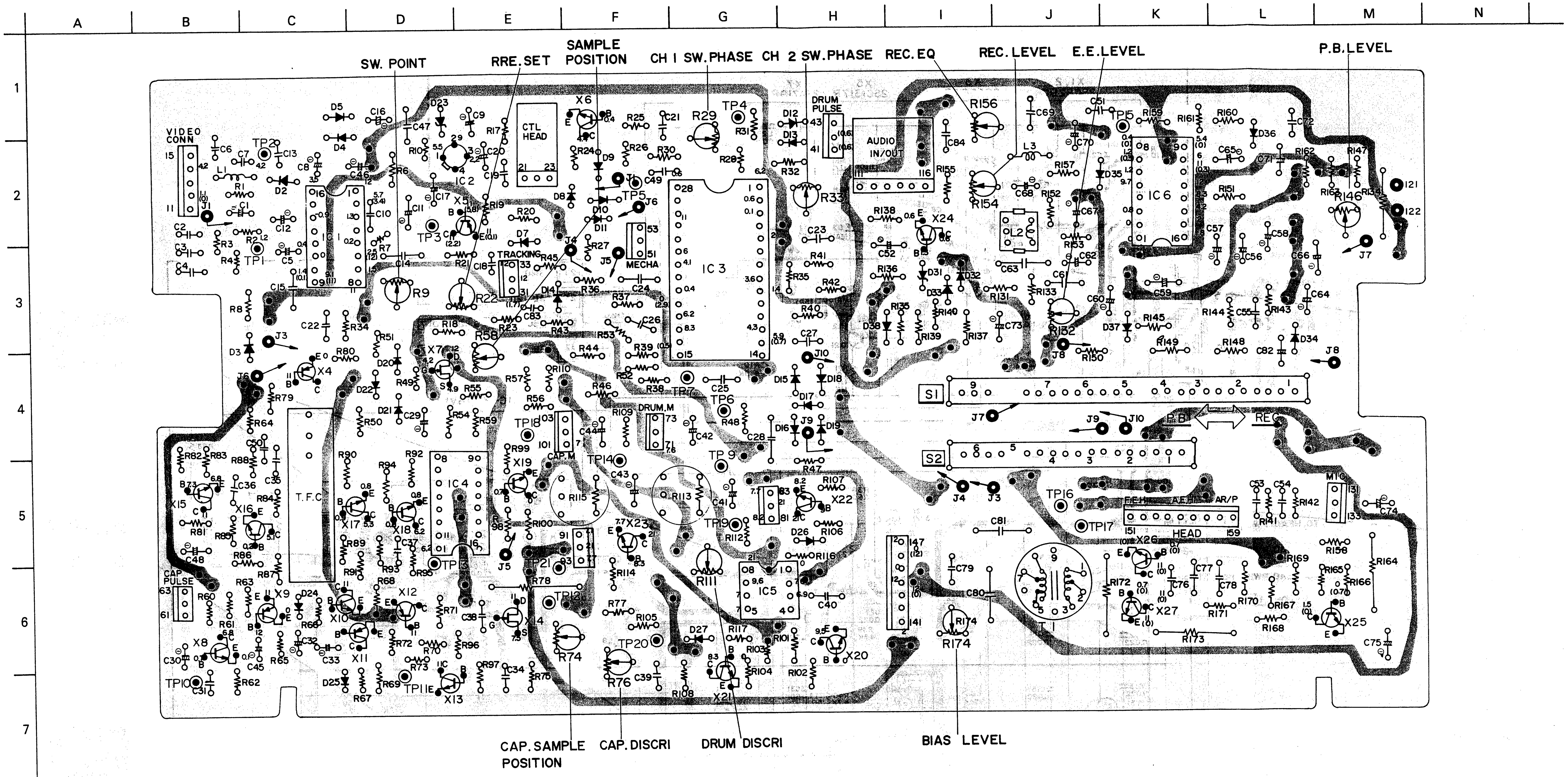

A B C D E F G H I J K L M N
1 2 3 4 5 6 7 8 9
TP-1
7~9 Vp-p
50 Hz
TP-2
1~1.5 Vp-p
15.625 kHz
TP-10
0.1V
0.2 Vp-p
TP-12
7.0 V DC
TP-11
5.0 Vp-p
TP-15
TP-3 (REC)
2.2 Vp-p
25 Hz
TP-3 (P.B)
0.6Vp-p~
25 Hz
TP-4
25 Hz
TP-13
10 Vp-p
475.2 Hz
TP-6
DC 4.3 V
TP-7
(P.B) 9 Vp-p T=9 m sec
(REC) 9 Vp-p T=4 m sec
TP-5
10 Vp-p
25 Hz
TP-9
TP-16,TP-17 (REC)
80 Vp-p (TP-16)
60 Vp-p (TP-17)
70~80 kHz
CTL. HEAD
DRUM P.U. HEAD
MANUAL
FIX
TRACKING 250 K
AUDIO & SERVO
SYNC OUT
CTL OUT
SW. POINT
DRUM PULSE IN
CH-2 SW. PHASE
DRUM (SAMPLE ERROR)
SAMPLE POSITION
IC2 (AN 608)
IC3 (AN 318)
IC1 (AN 301)
IC4 (CD4520BE)
IC5 (μPC 4558C)
IC6 (AN 262)
VIDEO IN
PRE. SET
DRUM F.F OUT
(DRUM PULSE)
(TRAPEZOID)
DRUM INVERT IN
(D.C. BIAS)
DRUM MOTOR
POWER TR.
X14 2SK40C
(CAP SAMPLE ERROR)
CAP. DISCRI
(OSC OUT)
DRUM NON-INVERT IN
DRUM DISCRI
DRUM M.D.A OUT
CAP. M.D.A
CAP. NON INVERT IN
CAP. INVERT IN
CAPSTAN MOTOR
CAP. P.U HEAD
CAP. PULSE IN
CAP. PHASE ERROR
(CAP. PULSE)
CAP. (TRAPEZOID)
CAP. SAMPLE POSITION
(AUDIO OUT)
REC.12V OUT
AUDIO IN
AUDIO OUT
E.E LEVEL
P.B. LEVEL
REC. LEVEL
REC. EQ
BIAS LEVEL
(AUDIO HEAD)
AUDIO HEAD IN
ERASE HEAD
F.E. HEAD
A.E. HEAD
AUDIO A HEAD
REC. LAMP
PAUSE 12 V
A.L. 12V
MIC

- ➡ (shaded) : Reference signal path and **Audio** signal
- ➡ : **Drum servo** comparison signal path
- ➡ (light) : Capstan servo comparison signal path

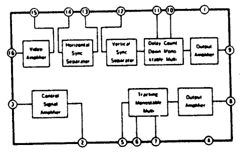
NOTE:

1. Unless otherwise specified;
   All PNP transistors are 2SC829C.
   All NPN transistors are 2SA564Q.
   All diodes are MA150LF.
   All resistance values are in ohms, ¼ W, ±10%.
   All capacitance values are μF.
2. All voltages are DC-measured with a V.T.V.M. at record mode.
   ( ) represents the DC voltage at playback mode.

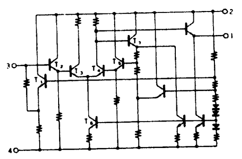
10-12 AUDIO AND SERVO (A/S) CIRCUIT BOARD


A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
SW. POINT
RRE. SET
SAMPLE POSITION
CH 1 SW. PHASE
CH 2 SW. PHASE
REC. EQ
REC. LEVEL
E.E. LEVEL
P.B. LEVEL
VIDEO CONN
CTL HEAD
DRUM PULSE
AUDIO IN/OUT
TRACKING
MECHA
IC 2
IC 3
IC 4
IC 5
IC 6
T.F.C
DRUM.M
CAP.M
CAP PULSE
S1
S2
P.B
REC
HEAD
F.E.H
A.E.H
AR/P
MIC
CAP. SAMPLE POSITION
CAP. DISCRI
DRUM DISCRI
BIAS LEVEL

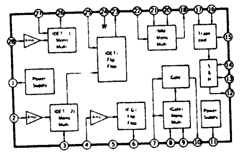
— AN301 —



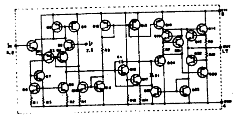
— AN608 —



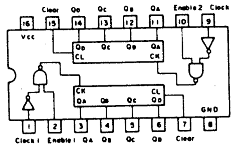
— AN318 —



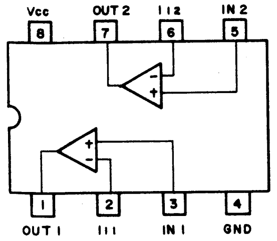
— AN262 —

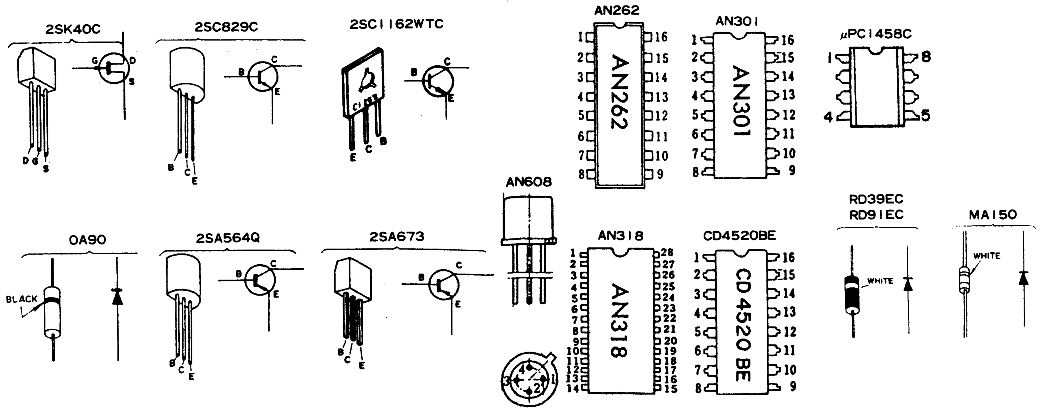


— CD4520BE —

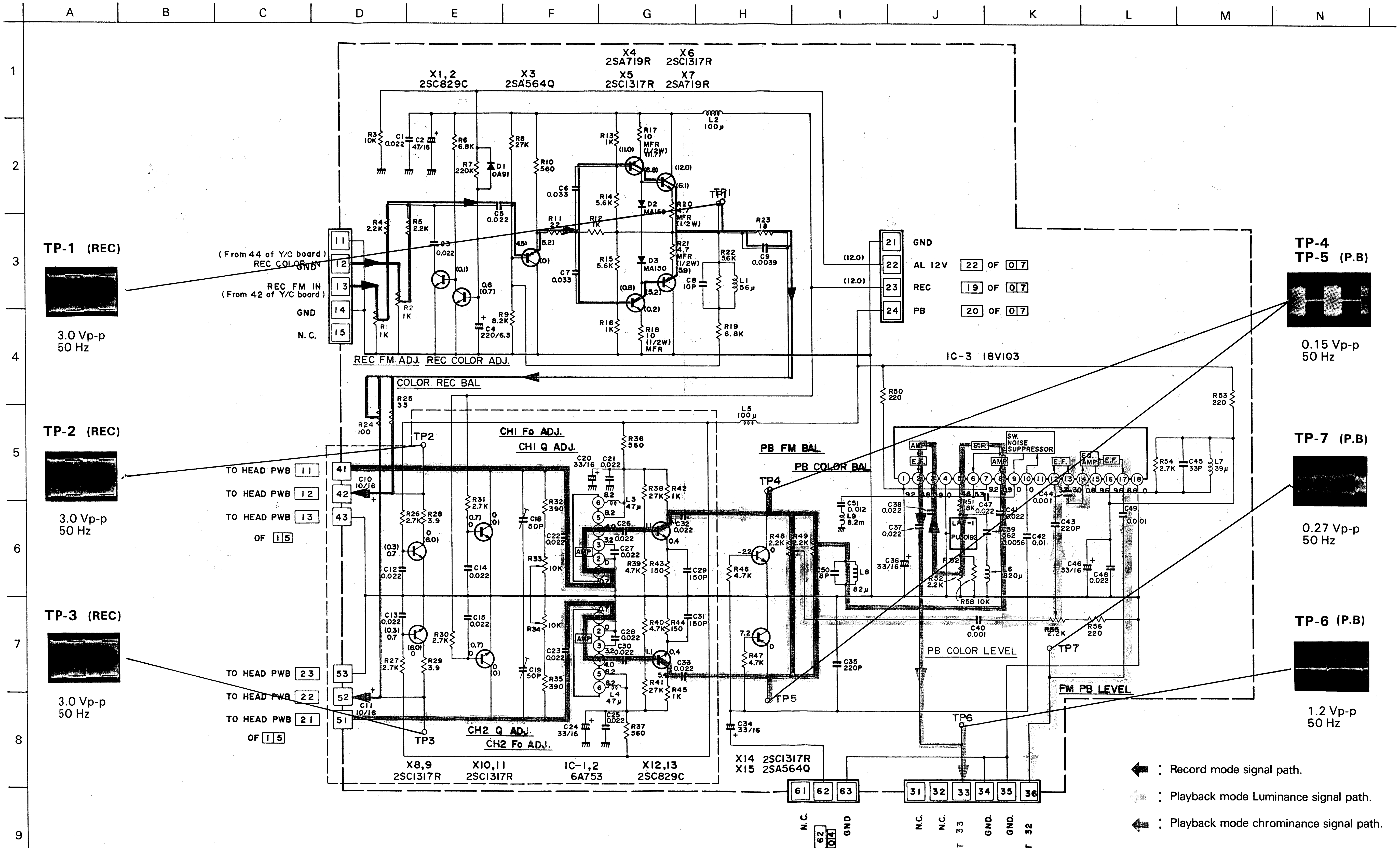


— UPC1458 —


Vcc
OUT 2
I 12
IN 2
8
7
6
5
1
2
3
4
OUT 1
I 11
IN 1
GND


2SK40C
2SC829C
2SC1162WTC
AN262
AN301
μPC1458C
0A90
2SA564Q
2SA673
AN608
AN318
CD4520BE
RD39EC
RD91EC
MA150
BLACK
WHITE

10-13 PRE AND RECORD (PRE/REC) CIRCUIT SCHEMATIC DIAGRAM


A B C D E F G H I J K L M N
1 2 3 4 5 6 7 8 9
TP-1 (REC)
3.0 Vp-p
50 Hz
TP-2 (REC)
3.0 Vp-p
50 Hz
TP-3 (REC)
3.0 Vp-p
50 Hz
TP-4
TP-5 (P.B)
0.15 Vp-p
50 Hz
TP-7 (P.B)
0.27 Vp-p
50 Hz
TP-6 (P.B)
1.2 Vp-p
50 Hz
X1,2 2SC829C
X3 2SA564Q
X4 2SA719R
X5 2SC1317R
X6 2SC1317R
X7 2SA719R
(From 44 of Y/C board) REC COLOR IN
REC FM IN (From 42 of Y/C board)
GND
N.C.
REC FM ADJ.
REC COLOR ADJ.
COLOR REC BAL
GND
AL 12V 22 OF 07
REC 19 OF 07
PB 20 OF 07
IC-3 18V103
SW. NOISE SUPPRESSOR
CH1 Fo ADJ.
CH1 Q ADJ.
CH2 Q ADJ.
CH2 Fo ADJ.
TO HEAD PWB 11
TO HEAD PWB 12
TO HEAD PWB 13
OF 15
TO HEAD PWB 23
TO HEAD PWB 22
TO HEAD PWB 21
OF 15
PB FM BAL
PB COLOR BAL
PB COLOR LEVEL
FM PB LEVEL
X8,9 2SC1317R
X10,11 2SC1317R
IC-1,2 6A753
X12,13 2SC829C
X14 2SC1317R
X15 2SA564Q
61 62 63
31 32 33 34 35 36
N.C.
F.F. IN 62 OF 04
GND
N.C.
N.C.
COLOR OUT 33
GND.
GND.
FM OUT 32

⬅ : Record mode signal path.

⬅ : Playback mode Luminance signal path.

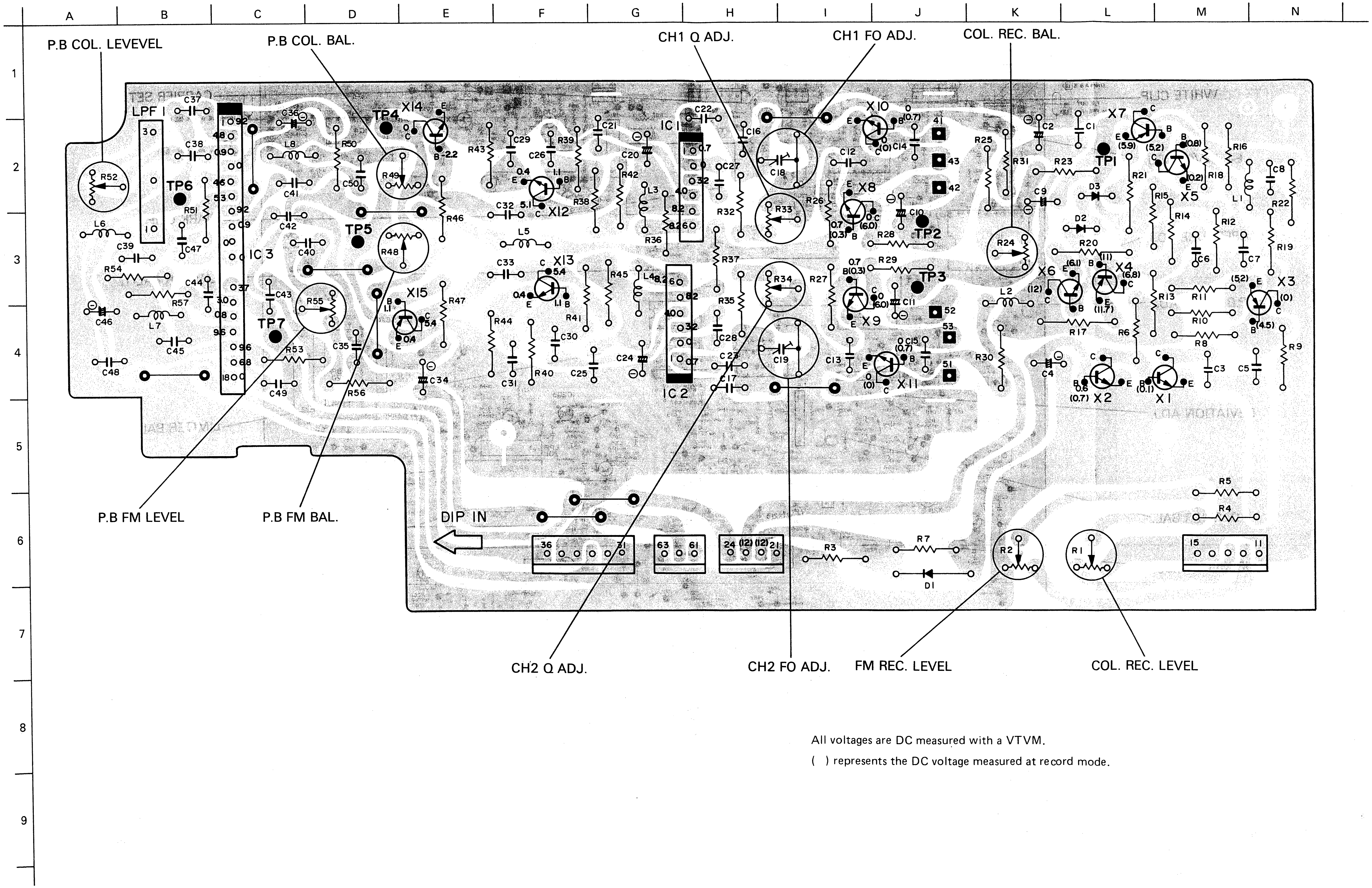
⬅ : Playback mode chrominance signal path.

All voltages are DC measured with a VTVM.

( ) represents the DC voltage measured at record mode.

NOTE: Unless otherwise specified;
All resistance values are in ohms 1/4 W, ±10%.
All capacitance values are μF.

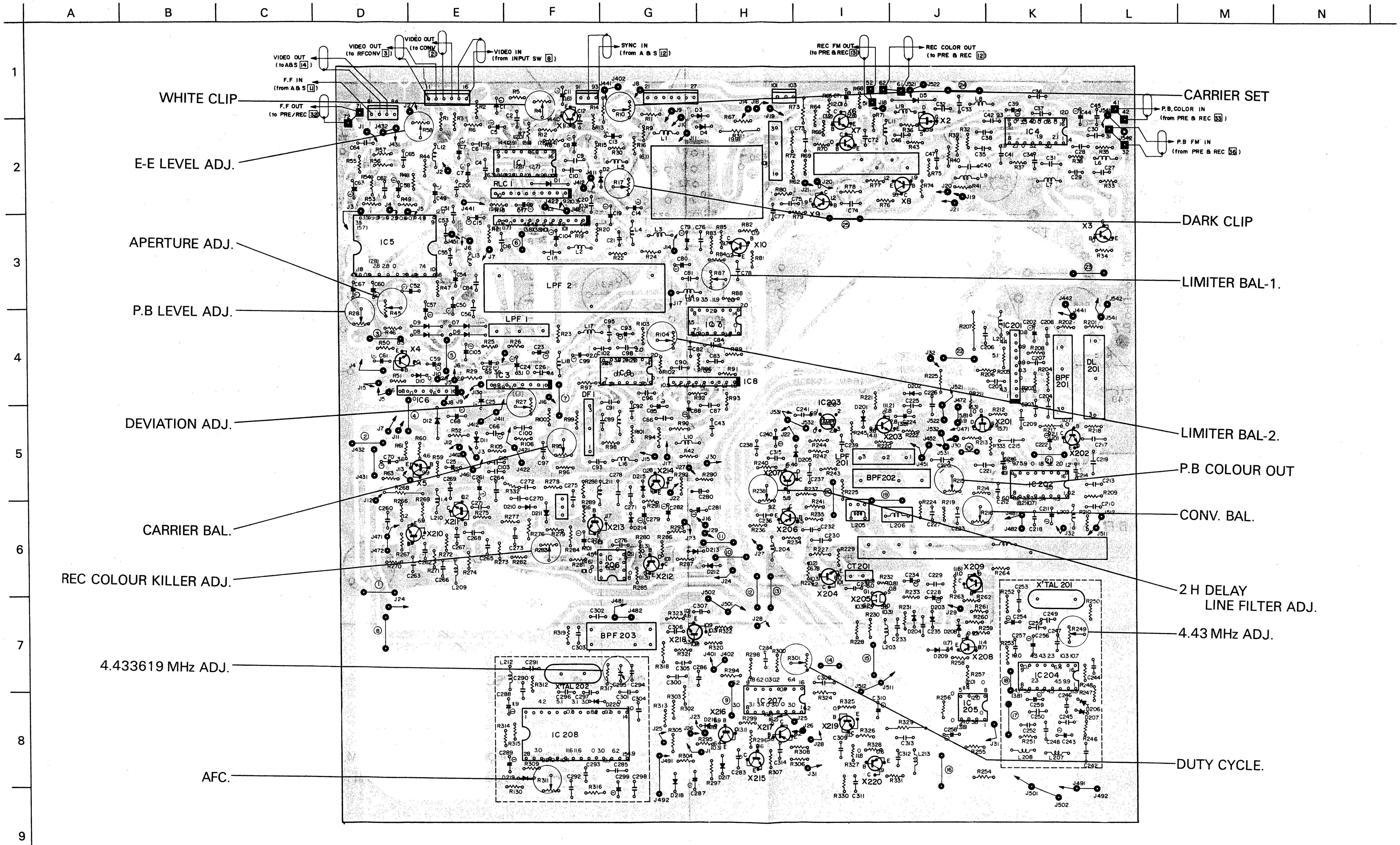
10-14 PRE AND RECORD (PRE/REC) CIRCUIT BOARD


A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
P.B COL. LEVEVEL
P.B COL. BAL.
CH1 Q ADJ.
CH1 FO ADJ.
COL. REC. BAL.
P.B FM LEVEL
P.B FM BAL.
DIP IN
CH2 Q ADJ.
CH2 FO ADJ.
FM REC. LEVEL
COL. REC. LEVEL
LPF 1
IC 1
IC 2
IC 3
TP1
TP2
TP3
TP4
TP5
TP6
TP7
X1
X2
X3
X4
X5
X6
X7
X8
X9
X10
X11
X12
X13
X14
X15
R1
R2
R24
R33
R34
R48
R49
R52
R55
C18
C19

All voltages are DC measured with a VTVM.

( ) represents the DC voltage measured at record mode.

10-15 LUMINANCE AND CHROMINANCE (Y/C) CIRCUIT BOARD


A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
VIDEO OUT (to RFCONV 3)
VIDEO OUT (to CONV 2)
VIDEO IN (from INPUT SW 8)
VIDEO OUT (to A&S 14)
F.F IN (from A&S 11)
F.F OUT (to PRE/REC 32)
SYNC IN (from A & S 12)
REC FM OUT (to PRE & REC 13)
REC COLOR OUT (to PRE & REC 12)
P.B. COLOR IN (from PRE & REC 33)
P.B FM IN (from PRE & REC 36)
WHITE CLIP
E-E LEVEL ADJ.
APERTURE ADJ.
P.B LEVEL ADJ.
DEVIATION ADJ.
CARRIER BAL.
REC COLOUR KILLER ADJ.
4.433619 MHz ADJ.
AFC.
CARRIER SET
DARK CLIP
LIMITER BAL-1.
LIMITER BAL-2.
P.B COLOUR OUT
CONV. BAL.
2 H DELAY
LINE FILTER ADJ.
4.43 MHz ADJ.
DUTY CYCLE.
IC5
LPF 2
LPF 1
RLC 1
DF1
IC6
IC8
IC4
IC201
BPF 201
DL 201
IC203
LPF 201
BPF202
IC206
CT201
BPF 203
X'TAL 202
IC 208
IC 207
IC 205
IC 204
X'TAL 201

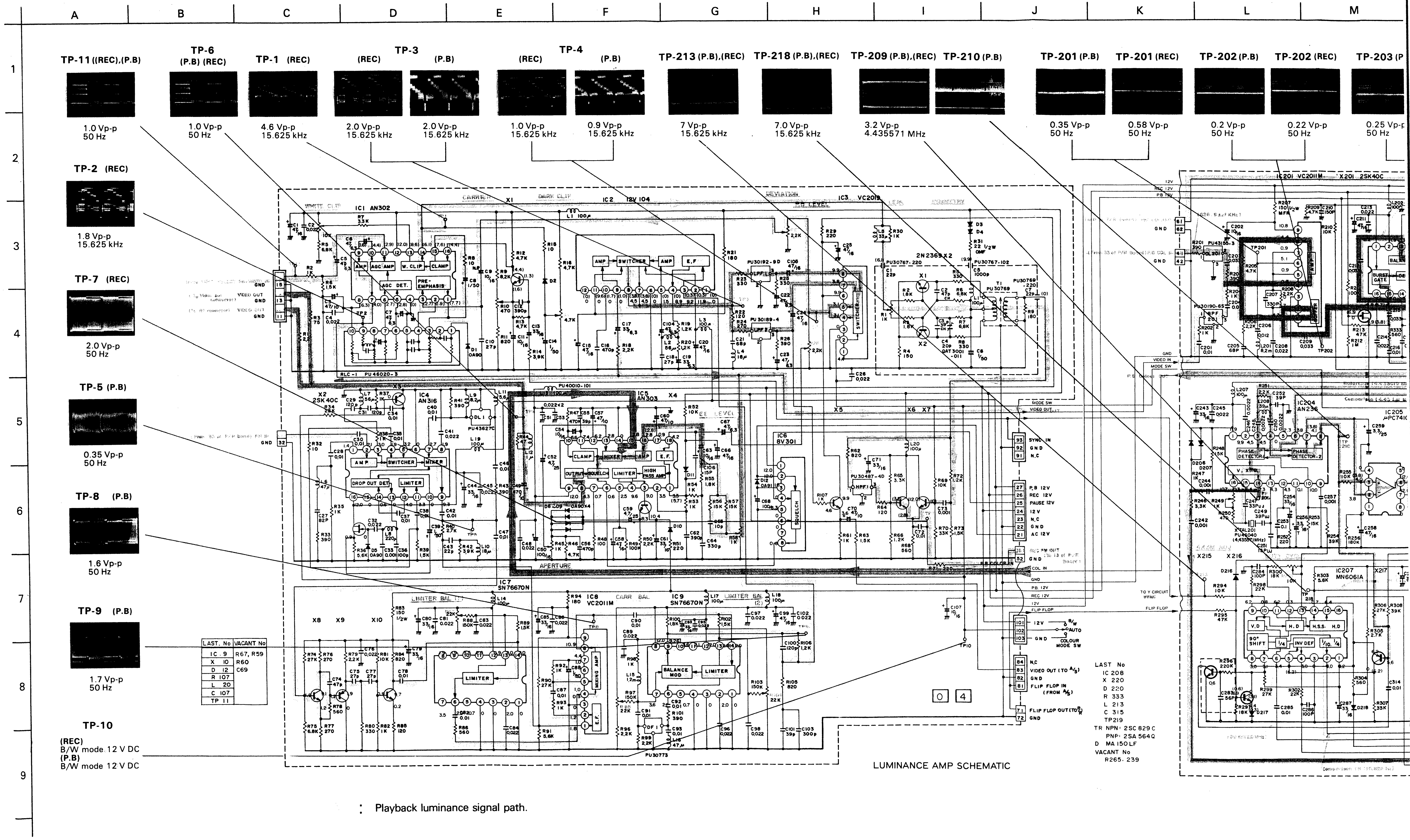
All reference numbers of components in colour circuit diagram are started from 201.

All voltages are DC measured with a VTVM.

( ) represents the DC voltage measured at record mode.

X213, 214, 215, D205, 214–216, CF201, C272, 275, 277–283,314,R288–293, 296,L211, TP-212 and D221 are mounted on HR-3300EG only.
R332 is mounted on HR-3300EK only.

10-16 LUMINANCE AND CHROMINANCE (Y/C) CIRCUIT SCHEMATIC DIAGRAM


A
B
C
D
E
F
G
H
I
J
K
L
M
1
2
3
4
5
6
7
8
9
TP-11 ((REC),(P.B)
1.0 Vp-p
50 Hz
TP-6
(P.B) (REC)
1.0 Vp-p
50 Hz
TP-1 (REC)
4.6 Vp-p
15.625 kHz
TP-3
(REC)
2.0 Vp-p
15.625 kHz
(P.B)
2.0 Vp-p
15.625 kHz
TP-4
(REC)
1.0 Vp-p
15.625 kHz
(P.B)
0.9 Vp-p
15.625 kHz
TP-213 (P.B),(REC)
7 Vp-p
15.625 kHz
TP-218 (P.B),(REC)
7.0 Vp-p
15.625 kHz
TP-209 (P.B),(REC)
3.2 Vp-p
4.435571 MHz
TP-210 (P.B)
TP-201 (P.B)
0.35 Vp-p
50 Hz
TP-201 (REC)
0.58 Vp-p
50 Hz
TP-202 (P.B)
0.2 Vp-p
50 Hz
TP-202 (REC)
0.22 Vp-p
50 Hz
TP-203 (P
0.25 Vp-p
50 Hz
TP-2 (REC)
1.8 Vp-p
15.625 kHz
TP-7 (REC)
2.0 Vp-p
50 Hz
TP-5 (P.B)
0.35 Vp-p
50 Hz
TP-8 (P.B)
1.6 Vp-p
50 Hz
TP-9 (P.B)
1.7 Vp-p
50 Hz
TP-10
(REC)
B/W mode 12 V DC
(P.B)
B/W mode 12 V DC
WHITE CLIP
IC1 AN302
CARRIER
X1
DARK CLIP
IC2 12V 104
DEVIATION
IC3 VC2019
AMP
AGC AMP
W. CLIP
CLAMP
AGC DET.
PRE-EMPHASIS
SWITCHER
E.F
PU30192-9D
PU30189-4
2N2369 X2
PU30767-220
PU30767-102
PU30769
RLC-1 PU46020-3
PU40010-101
X2 2SK40C
IC4 AN316
IC5 AN303
X4
X5
X6 X7
IC6 8V301
SQUELCH
PU30487-4D
HPF
AMP.
SWITCHER
MIXER
DROP OUT DET.
LIMITER
CLAMP
MIXER
AMP
E.F.
OUTPUT
SQUELCH
LIMITER
HIGH PASS AMP
APERTURE
EE LEVEL
IC7 SN76670N
LIMITER BAL
IC8 VC2011M
CARR BAL
IC9 SN76670N
LIMITER BAL (2)
X8 X9 X10
LIMITER
MIXING AMP
E.F.
BALANCE MOD
PU30773
SYNC IN
GND
N.C
P.B 12V
REC 12V
PAUSE 12V
12V
AC 12V
FM OUT
B/W
AUTO
COLOUR MODE SW
VIDEO OUT (TO A/S)
FLIP FLOP IN (FROM A/S)
FLIP FLOP OUT(TO P/R)
MODE SW
VIDEO OUT
IC201 VC2011M
X201 2SK40C
TP201
TP202
BURST GATE
IC204 AN236
PHASE DETECTOR-1
PHASE DETECTOR-2
IC205 μPC741C
X215 X216
IC207 MN6061A
V.D
H.D
H.S.S. H.D
90° SHIFT
INV DEF
TO Y CIRCUIT
FLIP FLOP
LUMINANCE AMP SCHEMATIC
0 4

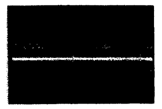
LAST. No	VACANT No
IC . 9	R67, R59
X 10	R60
D 12	C69
R 107	
L 20	
C 107	
TP 11	

LAST No
IC 208
X 220
D 220
R 333
L 213
C 315
TP219
TR NPN: 2SC 829 C
PNP: 2SA 564Q
D MA 150 LF
VACANT No
R265. 239

: Playback luminance signal path.

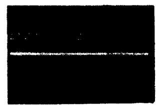
L	M	N	O	P	Q	R	S	T	U	V	W	X

TP-202 (P.B)



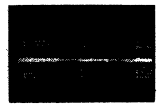
0.2 Vp-p
50 Hz

TP-202 (REC)



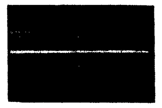
0.22 Vp-p
50 Hz

TP-203 (P.B)



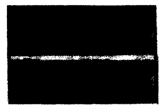
0.25 Vp-p
50 Hz

TP-203 (REC)



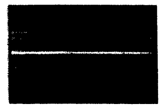
0.35 Vp-p
50 Hz

TP-204 (P.B)



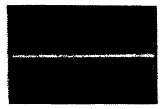
1.1 Vp-p
50 Hz

TP-205 (REC)



0.26 Vp-p
50 Hz

TP-206

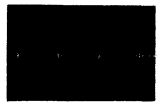


0.15 Vp-p
50 Hz

TP-207 (P.B)

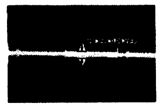
0.95 Vp-p
15.625 kHz

TP-217



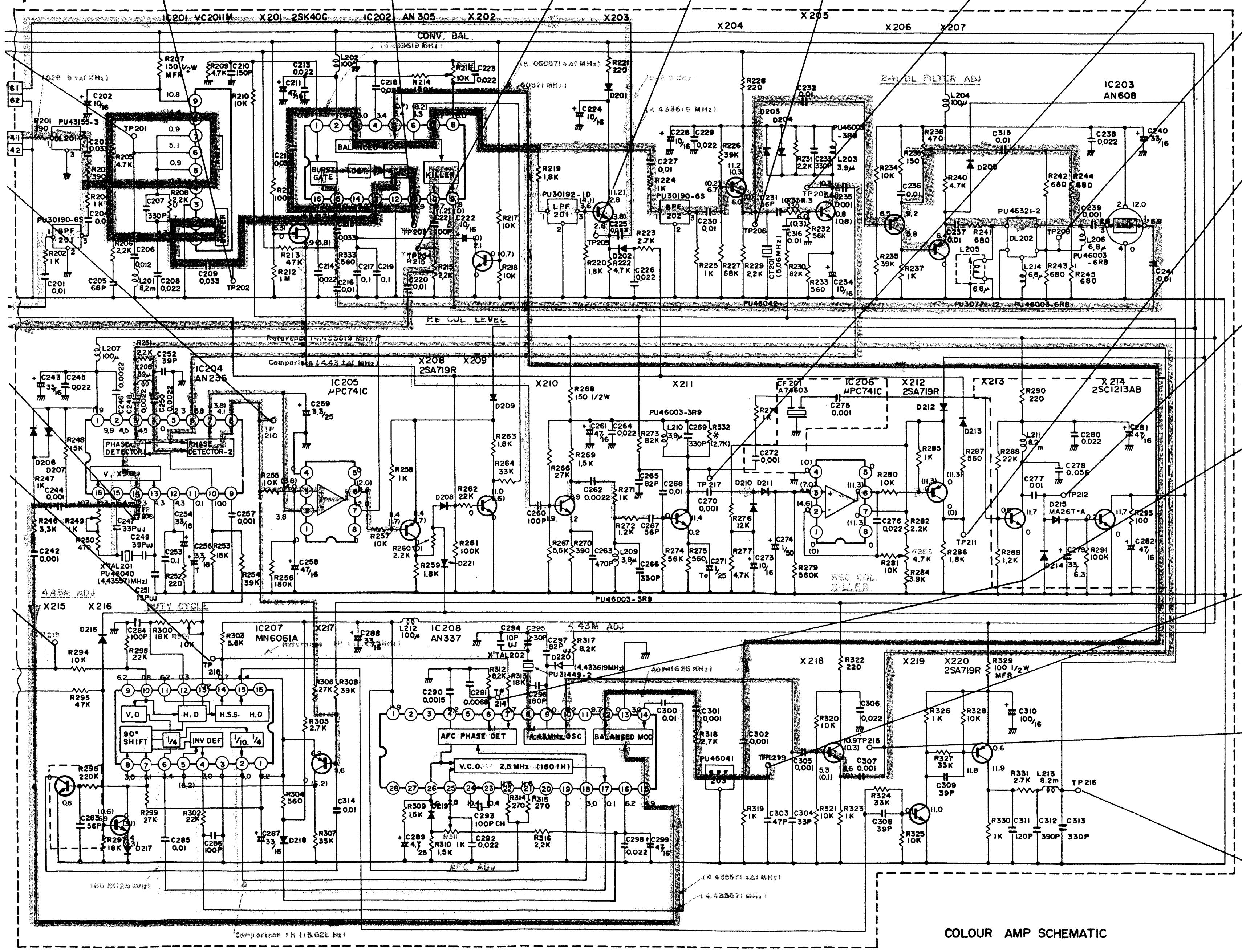
(P.B)
6.0 Vp-p 15.625 kHz
(REC)
5.5 Vp-p 15.625 kHz

TP-208 (P.B)



50 Hz

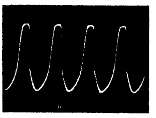
TP-211 (REC)
B/W Signal 11.8 V DC



IC201 VC2011M
X201 2SK40C
IC202 AN305
X202
X203
X204
X205
X206
X207
CONV. BAL
BALANCED MOD
BURST GATE
KILLER
2-H DL FILTER ADJ
IC203 AN608
PB COL LEVEL
IC204 AN236
PHASE DETECTOR-1
PHASE DETECTOR-2
IC205 μPC741C
X208 2SA719R
X209
X210
X211
IC206 μPC741C
X212 2SA719R
X213
X214 2SC1213AB
REC COL KILLER
4.43M ADJ
X215
X216
DUTY CYCLE
IC207 MN6061A
X217
IC208 AN337
AFC PHASE DET
4.43MHz OSC
BALANCED MOD
V.C.O. 2.5 MHz (160 fH)
AFC ADJ
X218
X219
X220 2SA719R
TP 218

COLOUR AMP SCHEMATIC

TP-212

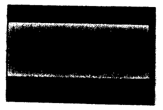


4.0 Vp-p
SECAM Signal in

TP-214 (REC),(P.B)

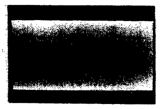
4.0 Vp-p
15.625 kHz

TP-219 (P.B),(REC)



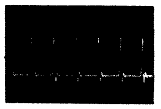
0.15 Vp-p
5.06 MHz

TP-215 (P.B)



1.1 Vp-p
4.433619 MHz

TP-216 (P.B),(REC)



11.0 Vp-p
15.625 kHz

All reference numbers of components in colour circuit diagram are started from 201.

All voltages are DC measured with a VTVM.

( ) represents the DC voltage measured at record mode.

X213, 214, 215, D205, 214–216, CF201, C272, 275, 277–283, 314, R288–293, 296, L211, and TP-212 ([ ]) are mounted on HR-3300EG only.

R332 is mounted on HR-3300EK only.

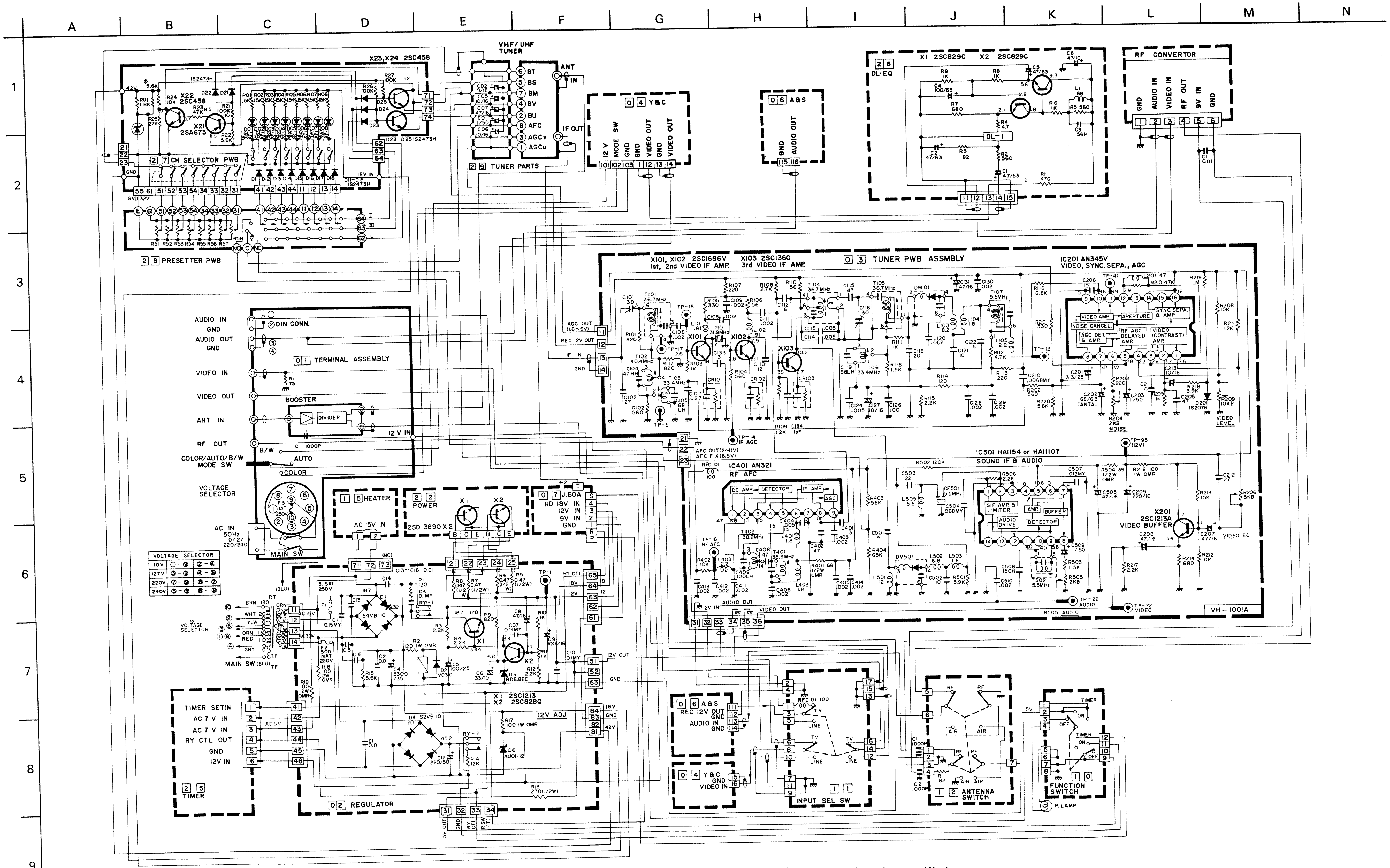
NOTE: Unless otherwise specified;
All PNP transistors are 2SA564Q.
All NPN transistors are 2SC829C.
All diodes are MA150LF
All resistance values are in ohms, 1/4 W, ±10%.
—⋀⋀— OMF : Oxide metal film resistor
+|⊟— : Electrolytic capacitor
—|⊟— : Non-polar electrolytic capacitor
—| |— : Mylar or ceramic capacitor

⇦ : Playback mode chrominance signal path and APC signal path.

⇦ : Record mode signal path.

: AFC signal path.

10-17 TUNER SCHEMATIC DIAGRAM (HR-3300EG)

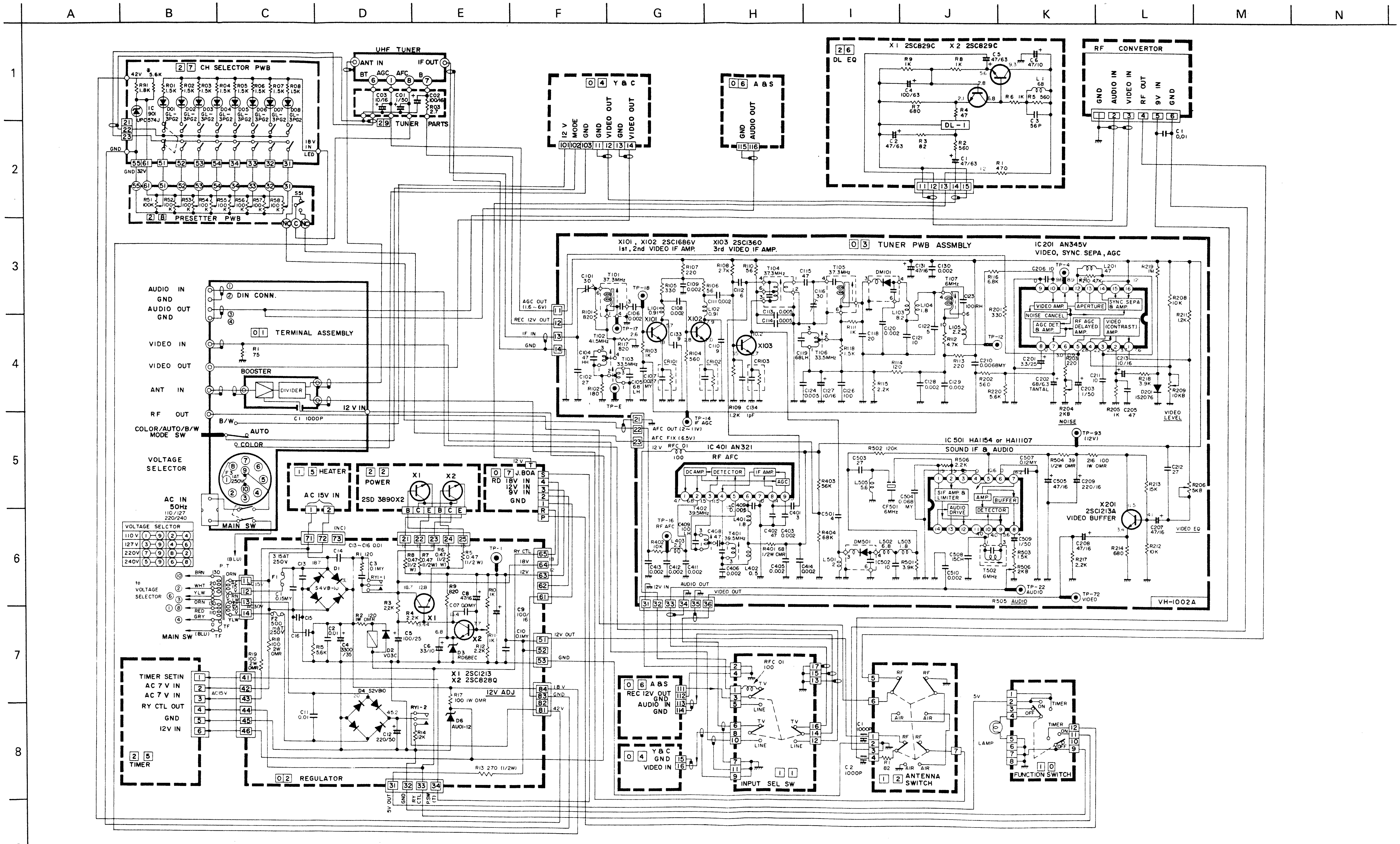

A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
X23, X24 2SC458
X22 2SC458
X21 2SA673
2 7 CH SELECTOR PWB
2 8 PRESETTER PWB
VHF/UHF TUNER
ANT IN
IF OUT
BT
BS
BM
BV
BU
AFC
AGCv
AGCu
2 9 TUNER PARTS
0 4 Y&C
12 V
MODE SW
GND
VIDEO OUT
GND
VIDEO OUT
0 6 A&S
GND
AUDIO OUT
2 6 DL-EQ
X1 2SC829C X2 2SC829C
DL-1
RF CONVERTOR
GND
AUDIO IN
VIDEO IN
RF OUT
9V IN
GND
AUDIO IN
GND
AUDIO OUT
GND
DIN CONN.
0 1 TERMINAL ASSEMBLY
VIDEO IN
VIDEO OUT
BOOSTER
DIVIDER
ANT IN
RF OUT
12 V IN
B/W
AUTO
COLOR
COLOR/AUTO/B/W MODE SW
VOLTAGE SELECTOR
AC IN 50Hz 110/127 220/240
MAIN SW
VOLTAGE SELECTOR
110V
127V
220V
240V
1 5 HEATER
AC 15V IN
2 2 POWER
2SD 389O X 2
0 7 J.BOA
RD 18V IN
12V IN
9V IN
GND
X101, X102 2SC1686V 1st, 2nd VIDEO IF AMP.
X103 2SC1360 3rd VIDEO IF AMP.
0 3 TUNER PWB ASSMBLY
IC201 AN345V VIDEO, SYNC. SEPA., AGC
VIDEO AMP
APERTURE
SYNC SEPA. & AMP.
NOISE CANCEL
AGC DET & AMP.
RF AGC DELAYED AMP.
VIDEO (CONTRAST) AMP.
AGC OUT (1.6~6V)
REC 12V OUT
IF IN
GND
TP-14 IF AGC
AFC OUT (2~11V)
AFC FIX (6.5V)
IC401 AN321 RF AFC
DC AMP
DETECTOR
IF AMP
AGC
IC501 HA1154 or HA1107 SOUND IF & AUDIO
SIF AMP & LIMITER
AMP
BUFFER
AUDIO DRIVE
DETECTOR
X201 2SC1213A VIDEO BUFFER
VIDEO EQ
VIDEO LEVEL
TP-22 AUDIO
TP-72 VIDEO
AUDIO OUT
VIDEO OUT
VH-1001A
TIMER SETIN
AC 7 V IN
AC 7 V IN
RY CTL OUT
GND
12V IN
2 5 TIMER
X1 2SC1213 X2 2SC828Q
12V ADJ
12V OUT
0 2 REGULATOR
5V OUT
GND
RY CTL
P.SW
0 6 A&S
REC 12V OUT
GND
AUDIO IN
GND
0 4 Y&C
GND
VIDEO IN
1 1 INPUT SEL SW
TV
LINE
1 2 ANTENNA SWITCH
AIR
RF
1 0 FUNCTION SWITCH
TIMER
ON
OFF
P. LAMP

All voltages are DC measured with a VTVM.

( ) represents the DC voltage measured at record mode.

NOTE: Unless otherwise specified;
All resistance values are in ohms 1/4 W, ±10%.
All capacitance values are μF.

10-18 TUNER SCHEMATIC DIAGRAM (HR-3300EK)

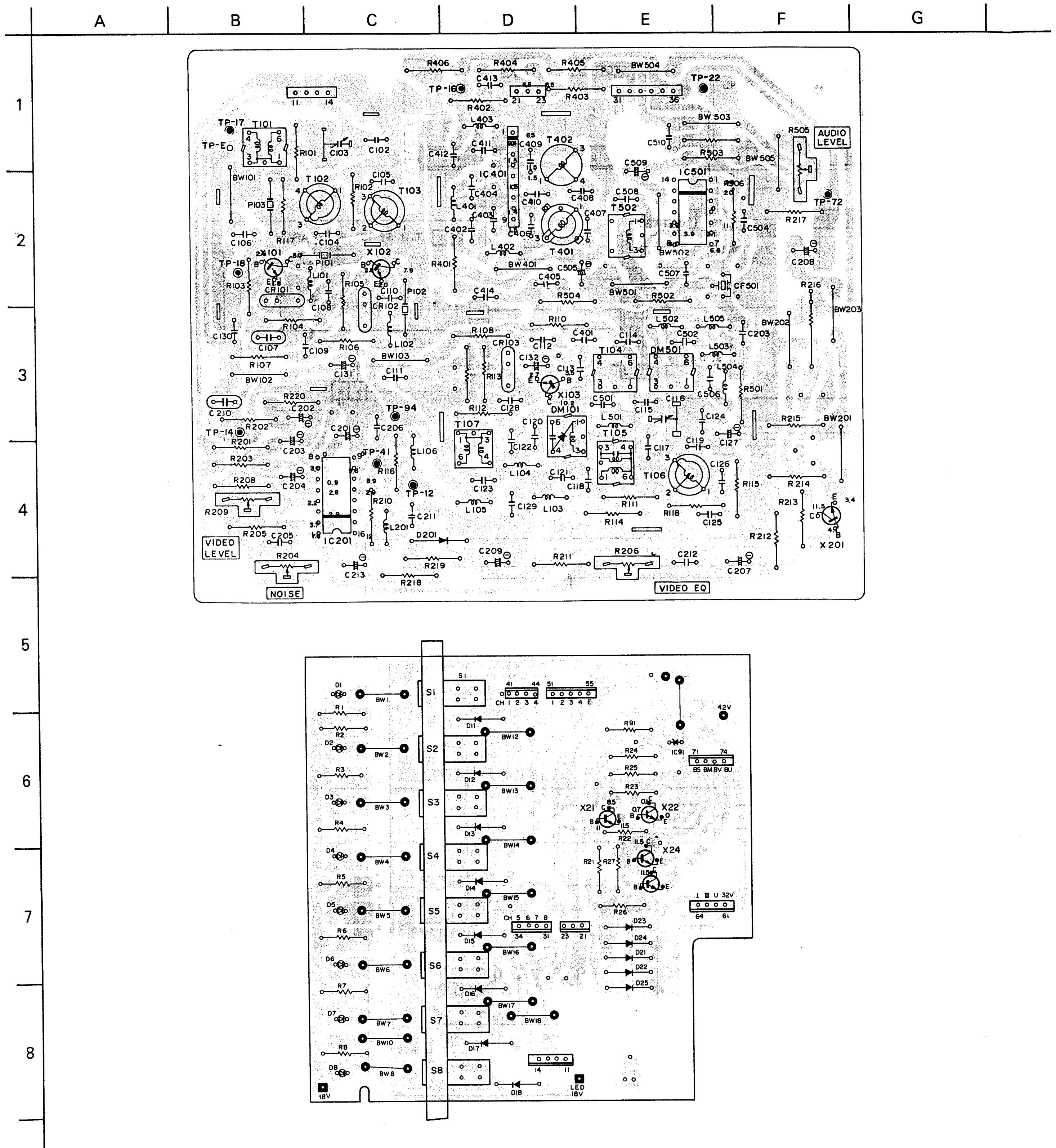

A B C D E F G H I J K L M N
1 2 3 4 5 6 7 8 9
27 CH SELECTOR PWB
28 PRESETTER PWB
UHF TUNER
29 TUNER PARTS
04 Y&C
06 A&S
26 DL EQ
X1 2SC829C X2 2SC829C
DL-1
RF CONVERTOR
GND
AUDIO IN
VIDEO IN
RF OUT
9V IN
GND
01 TERMINAL ASSEMBLY
AUDIO IN
AUDIO OUT
VIDEO IN
VIDEO OUT
ANT IN
RF OUT
DIN CONN.
BOOSTER
DIVIDER
COLOR/AUTO/B/W MODE SW
VOLTAGE SELECTOR
AC IN 50Hz 110/127 220/240
MAIN SW
03 TUNER PWB ASSMBLY
X101, X102 2SC1686V 1st, 2nd VIDEO IF AMP.
X103 2SC1360 3rd VIDEO IF AMP.
IC201 AN345V VIDEO, SYNC SEPA, AGC
VIDEO AMP.
APERTURE
SYNC SEPA & AMP.
NOISE CANCEL
AGC DET & AMP.
RF AGC DELAYED AMP.
VIDEO (CONTRAST) AMP
IC401 AN321 RF AFC
DC AMP
DETECTOR
IF AMP
AGC
IC501 HA1154 or HA1107 SOUND IF & AUDIO
SIF AMP & LIMITER
AMP
BUFFER
AUDIO DRIVE
DETECTOR
X201 2SC1213A VIDEO BUFFER
VH-1002A
15 HEATER
AC 15V IN
22 POWER
2SD 389OX2
07 J.BOA
02 REGULATOR
X1 2SC1213
X2 2SC828Q
12V ADJ
25 TIMER
TIMER SETIN
AC 7 V IN
AC 7 V IN
RY CTL OUT
GND
12V IN
06 A&S
REC 12V OUT
GND
AUDIO IN
GND
04 Y&C
GND
VIDEO IN
11 INPUT SEL SW
12 ANTENNA SWITCH
10 FUNCTION SWITCH
TIMER
LAMP

All voltages are DC measured with a VTVM.

( ) represents the DC voltage measured at record mode.

NOTE: Unless otherwise specified;
All resistance values are in ohms 1/4 W, ±10%.
All capacitance values are μF.

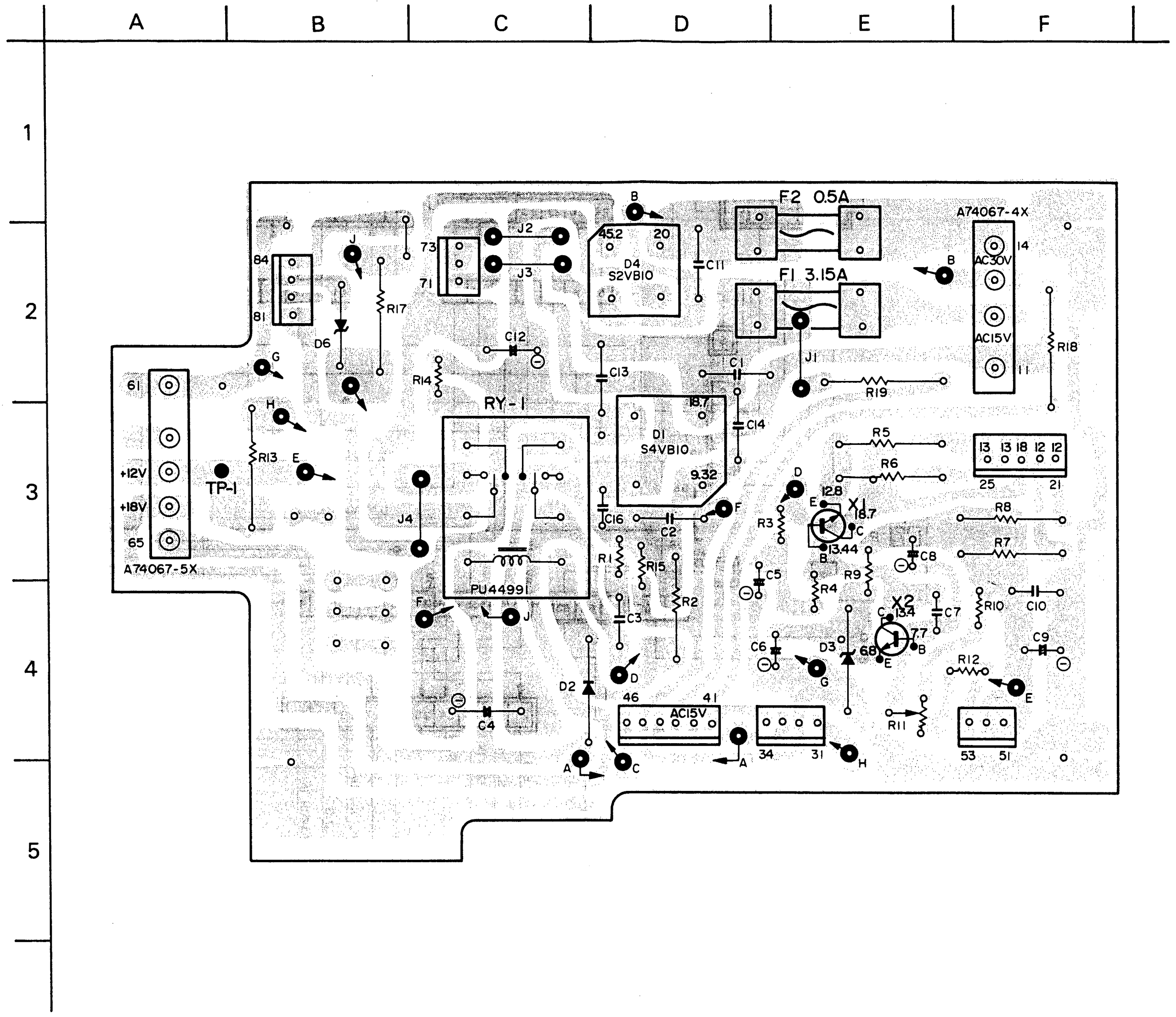
10-19 TUNER CIRCUIT BOARD AND CH SELECTOR


A
B
C
D
E
F
G
1
2
3
4
5
6
7
8
AUDIO LEVEL
VIDEO LEVEL
NOISE
VIDEO EQ
TP-17
TP-E
TP-18
TP-14
TP-16
TP-22
TP-72
TP-94
TP-41
TP-12
T101
T102
T103
T104
T105
T106
T107
T401
T402
T502
X101
X102
X103
X201
IC201
IC401
IC501
DM101
DM501
CR101
CR102
CR103
S1
S2
S3
S4
S5
S6
S7
S8
X21
X22
X24
IC91
42V
18V
LED 18V

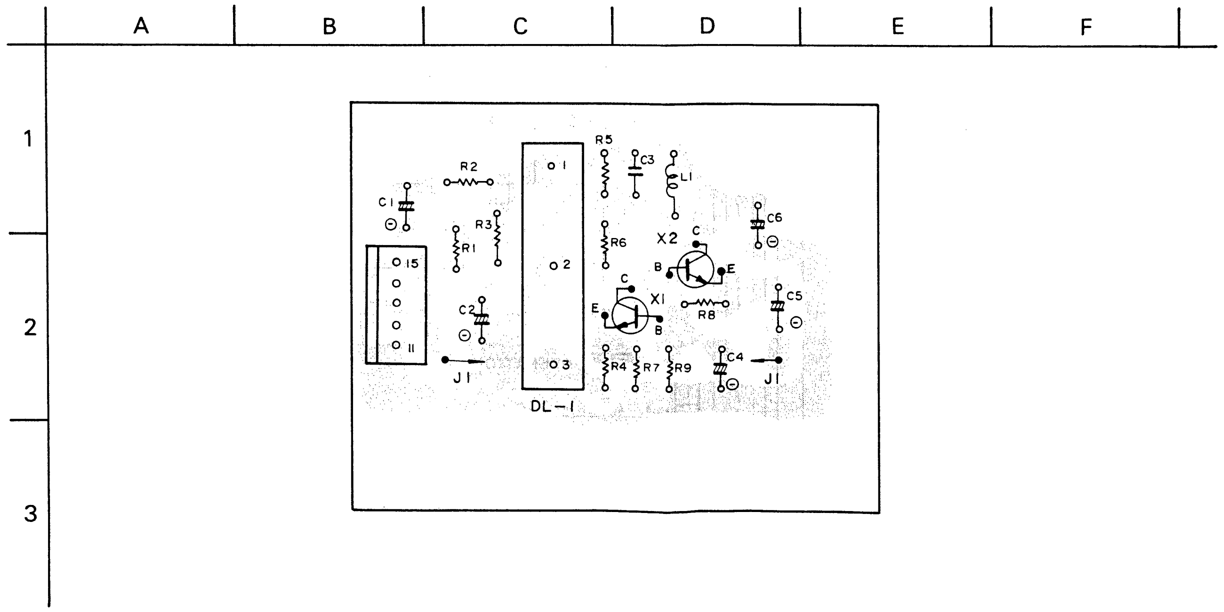
All voltages are DC measured with a VTVM.
( ) represents the DC voltage measured at record mode.

NOTE: Unless otherwise specified;
All resistance values are in ohms 1/4 W, ±10%.
All capacitance values are μF.

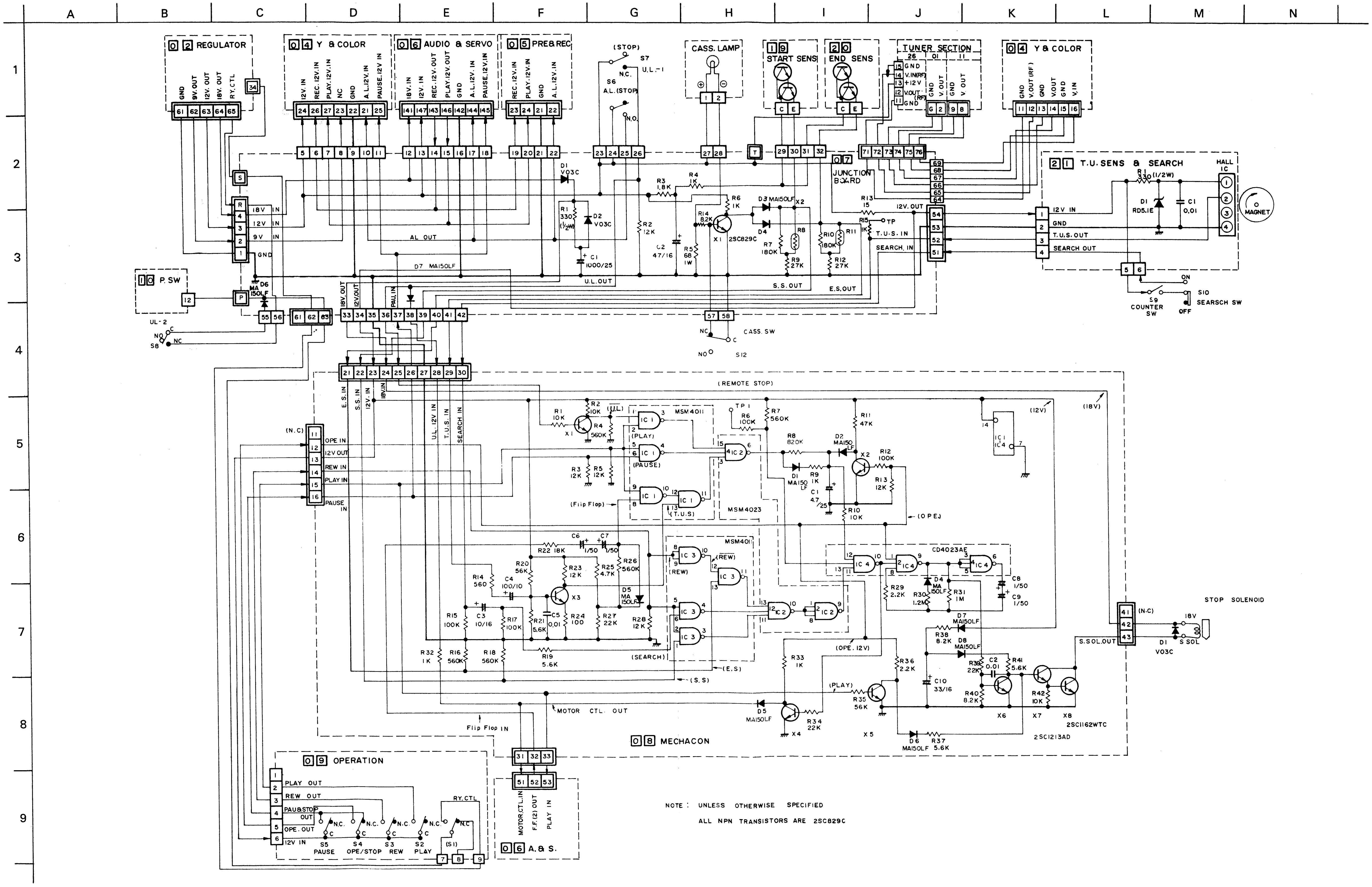
10-20 REGULATOR CIRCUIT BOARD


A
B
C
D
E
F
1
2
3
4
5
F2 0.5A
F1 3.15A
A74067-4X
A74067-5X
AC30V
AC15V
+12V
+18V
TP-1
RY-1
PU4499
D1 S4VB10
D4 S2VB10
X1
X2
J1
J2
J3
J4
D2
D3
D6

10-21 DELAY EQULAIZER (DL. EQ.) CIRCUIT BOARL

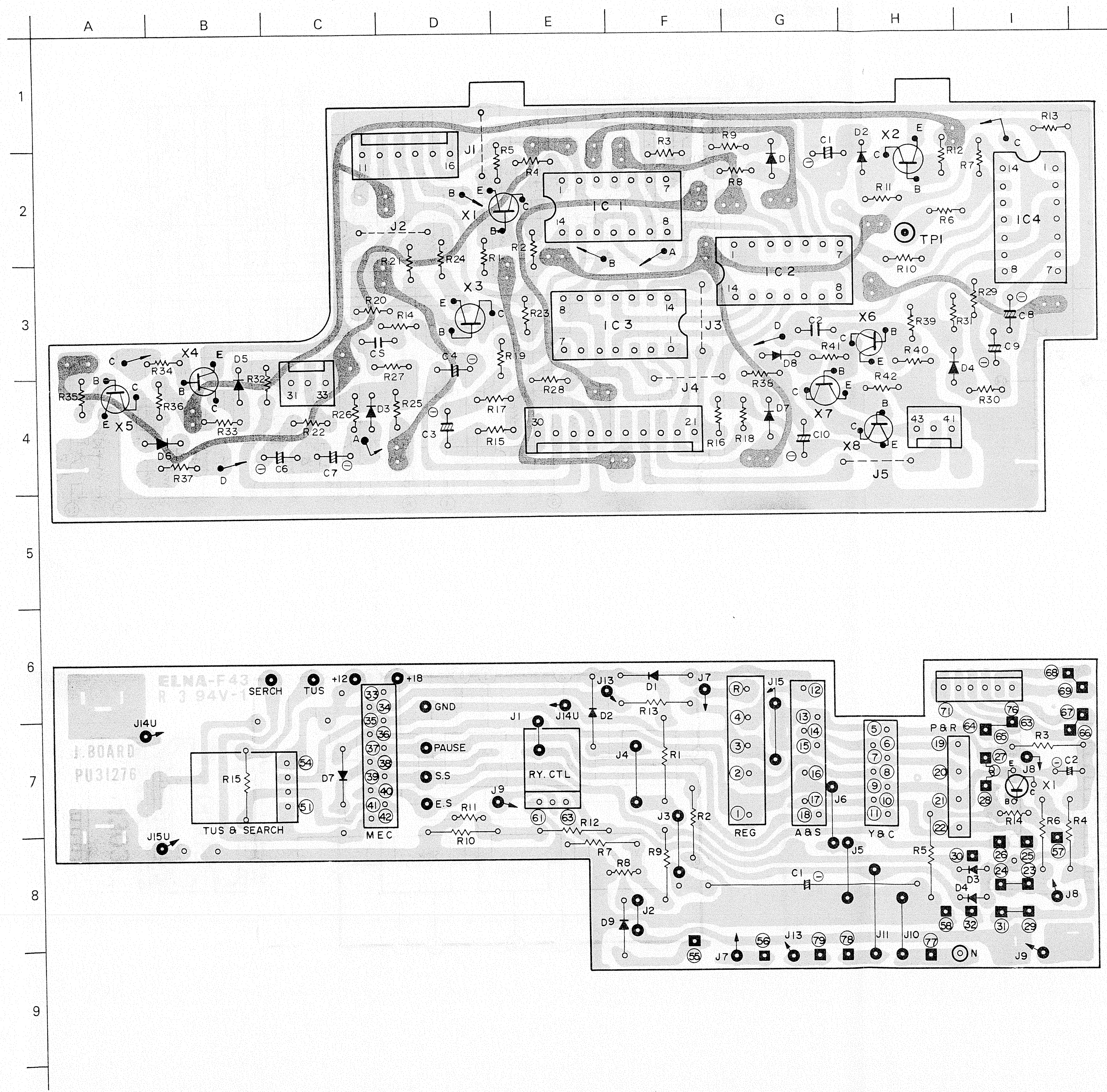

A
B
C
D
E
F
1
2
3
DL-1
X1
X2
J1
L1

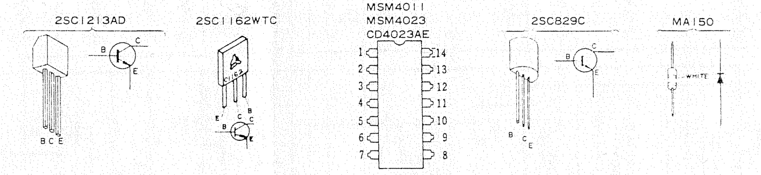
10-22 MECHANISM CONTROL CIRCUIT AND JUNCTION BOARD SCHEMATIC DIAGRAM


A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
02 REGULATOR
GND
9V. OUT
12V. OUT
18V. OUT
RY. CTL
04 Y & COLOR
12V. IN
REC. 12V. IN
PLAY. 12V. IN
NC
GND
A.L. 12V. IN
PAUSE. 12V. IN
06 AUDIO & SERVO
18V. IN
12V. IN
REC. 12V. OUT
PLAY. 12V. OUT
GND
A.L. 12V. IN
PAUSE. 12V. IN
05 PRE & REC
REC. 12V. IN
PLAY. 12V. IN
GND
A.L. 12V. IN
(STOP)
S7
N.C.
U.L.-1
S6
A.L. (STOP)
N.O.
CASS. LAMP
19 START SENS
20 END SENS
TUNER SECTION
GND
V. IN (RF)
+12V
V. OUT (RF)
GND
V. OUT
V. OUT
04 Y & COLOR
GND
V. OUT (RF)
GND
V. OUT
GND
V. IN
07 JUNCTION BOARD
D1 V03C
R1 330 (1/2W)
D2 V03C
C1 1000/25
R2 12K
C2 47/16
R3 1.8K
R4 1K
R5 68 1W
R6 1K
R14 8.2K
X1 2SC829C
D3 MA150LF
X2
D4
R7 180K
R8
R9 27K
R10 180K
R11
R12 27K
R13 15
R15 1K
TP
12V. OUT
T.U.S. IN
SEARCH. IN
18V IN
12V IN
9V IN
GND
AL OUT
D7 MA150LF
U.L. OUT
S.S. OUT
E.S. OUT
21 T.U. SENS & SEARCH
HALL IC
R1 330 (1/2W)
D1 RD5.1E
C1 0.01
12V IN
GND
T.U.S. OUT
SEARCH OUT
MAGNET
S9 COUNTER SW
ON
OFF
S10 SEARSCH SW
10 P. SW
D6 MA 150LF
UL-2
S8
NO
NC
C
18V. OUT
12V. OUT
PAU. IN
CASS. SW
S12
E.S. IN
S.S. IN
12V. IN
18V. IN
U.L. 12V. IN
T.U.S. IN
SEARCH IN
(REMOTE STOP)
(N.C)
OPE IN
12V OUT
REW IN
PLAY IN
PAUSE IN
R1 10K
R2 10K
X1
R4 560K
(UL)
IC 1
MSM4011
(PLAY)
(PAUSE)
R3 12K
R5 12K
(Flip Flop)
(T.U.S)
TP 1
R6 100K
R7 560K
IC 2
MSM4023
R8 820K
D1 MA150 LF
R9 1K
C1 4.7/25
D2 MA150 LF
X2
R10 10K
R11 47K
R12 100K
R13 12K
(OPE)
IC 1 IC 4
(12V)
(18V)
R22 18K
C6 1/50
C7 1/50
MSM401
IC 3
(REW)
R14 560
R20 56K
C4 100/10
R23 12K
R25 4.7K
R26 560K
X3
D5 MA 150LF
R15 100K
C3 10/16
R17 100K
R21 5.6K
C5 0.01
R24 100
R27 22K
R28 12K
(SEARCH)
R32 1K
R16 560K
R18 560K
R19 5.6K
(E.S)
(S.S)
CD4023AE
IC 4
D4 MA 150LF
R29 2.2K
R30 1.2M
R31 1M
C8 1/50
C9 1/50
D7 MA150LF
R38 8.2K
D8 MA150LF
(OPE. 12V)
R33 1K
R36 2.2K
C10 33/16
R39 22K
C2 0.01
R41 5.6K
R40 8.2K
R42 10K
(PLAY)
R35 56K
D5 MA150LF
X4
R34 22K
X5
D6 MA150LF
R37 5.6K
X6
X7
X8
2SC1162WTC
2SC1213AD
MOTOR CTL. OUT
Flip Flop IN
08 MECHACON
STOP SOLENOID
(N.C)
18V
S.SOL. OUT
D1 V03C
S SOL
09 OPERATION
PLAY OUT
REW OUT
PAU & STOP OUT
OPE. OUT
12V IN
RY. CTL
S5 PAUSE
S4 OPE/STOP
S3 REW
S2 PLAY
(S1)
N.C.
C
MOTOR CTL. IN
F.F. (2) OUT
PLAY IN
06 A. & S.

NOTE : UNLESS OTHERWISE SPECIFIED
ALL NPN TRANSISTORS ARE 2SC829C

10-23 MECHANISM CONTROL CIRCUIT AND JUNCTION BOARD


A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
J1
J2
J3
J4
J5
IC 1
IC 2
IC 3
IC 4
TP1
X1
X2
X3
X4
X5
X6
X7
X8
D2
D3
D4
D5
D6
D7
D8
R13
C8
C9
C10
ELNA-F43
R 3 94V-1
J.BOARD
PU31276
SEARCH
TUS
+12
+18
GND
PAUSE
S.S
E.S
J14U
J15U
TUS & SEARCH
MEC
RY. CTL
REG
A&S
Y&C
P&R
J6
J7
J8
J9
J10
J11
J13
D1
D9
R15
R10
R11
R12
R7
R8
R9
R1
R2
R3
R4
R5
R6
R14
C1
C2


2SC1213AD
B
C
E
2SC1162WTC
C1162
MSM4011
MSM4023
CD4023AE
1
2
3
4
5
6
7
8
9
10
11
12
13
14
2SC829C
MA150
WHITE

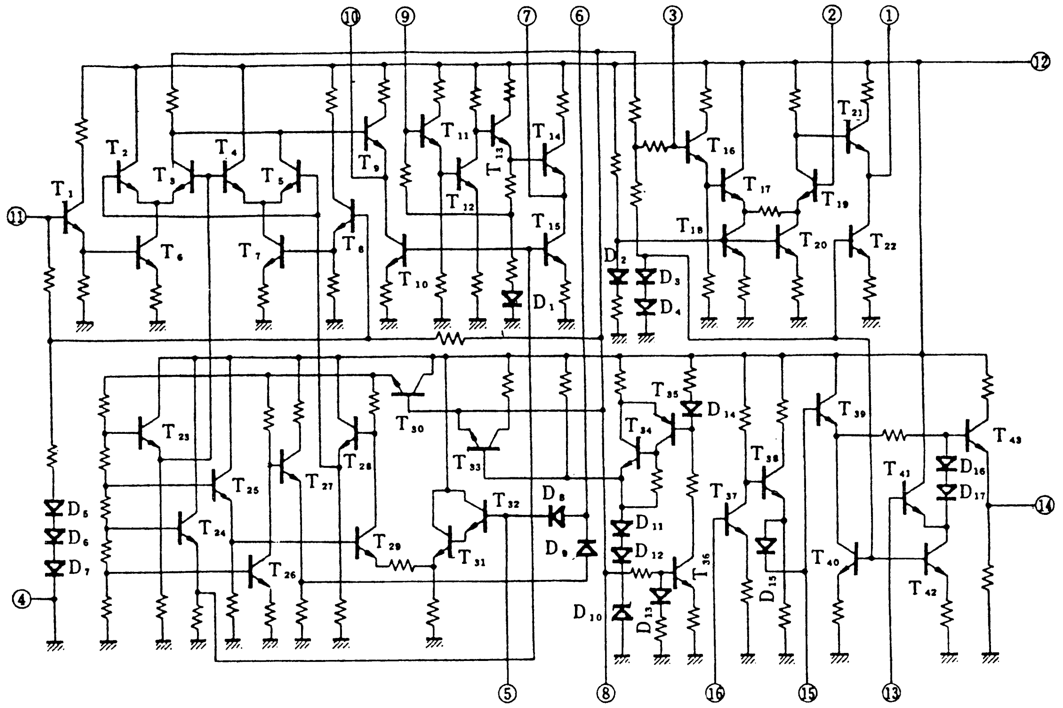
OPERATING CHARACTERISTICS OF THE MECHANISM CONTROL SYSTEM

1) The machine will not operate unless a cassette is inserted.
2) If the filament of the cassette lamp opens while the machine is in PLAY (or RECORD), the machine stops when unloading is complete. If the filament opens while the machine is in Fast Forward (F.F.) or Rewind (REW), the machine goes into STOP mode.
3) When the end of tape is reached during Play, a stop pulse is generated to initiate unloading. The machine goes to stop when the tape has returned to the cassette. In the above condition, PLAY and F.F. are inoperative. Only REW available.
4) When the biginning of the tape is reached during REW, a stop pulse is generated to stop the operation. If the above condition, REW is inoperative. PLAY and F.F. are available.
5) If the search switch is set to ON position, during REW mode, the machine will stop when 000 is reached.
6) During F.F. or REW, if power cut off, mode mechanical lock is released.
7) When the play mode, power is cut off, mode mechanical lock is released, when power applied tape will unload and stop.
8) When the take-up reel disk is stopped rotation, except PAUSE mode, tape automatically unloads and stop after 4–5 seconds from such time.
9) When drum stops rotation in play mode, tape automatically unloads and stop after 4–5 seconds from such time.
10) When the take-up reel disk stops rotation for 5–6 seconds after PLAY key depressed, tape automatically unloads and stops.
11) When the power switch is turned off after F.F. or REW key is locked by function mechanism, except PLAY or RECORD mode, the machine automatically stops.
12) The drum and capstan motor are rotating except STOP mode. However, if the end of tape is reached during F.F., drum and capstan motor stop rotation. And if the beginning of the tape is reached during REW mode, drum and capstan motor stop rotation.

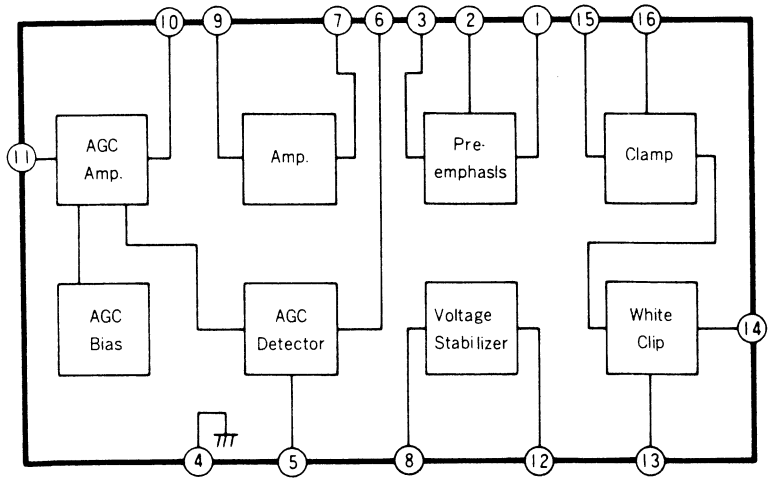
10-24 SCHEMATIC DIAGRAM OF ICs

– AN302 –

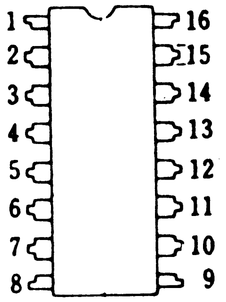
IC 1 of Y/C Board.



⑩
⑨
⑦
⑥
③
②
①
⑫
⑪
④
⑭
⑤
⑧
⑯
⑮
⑬



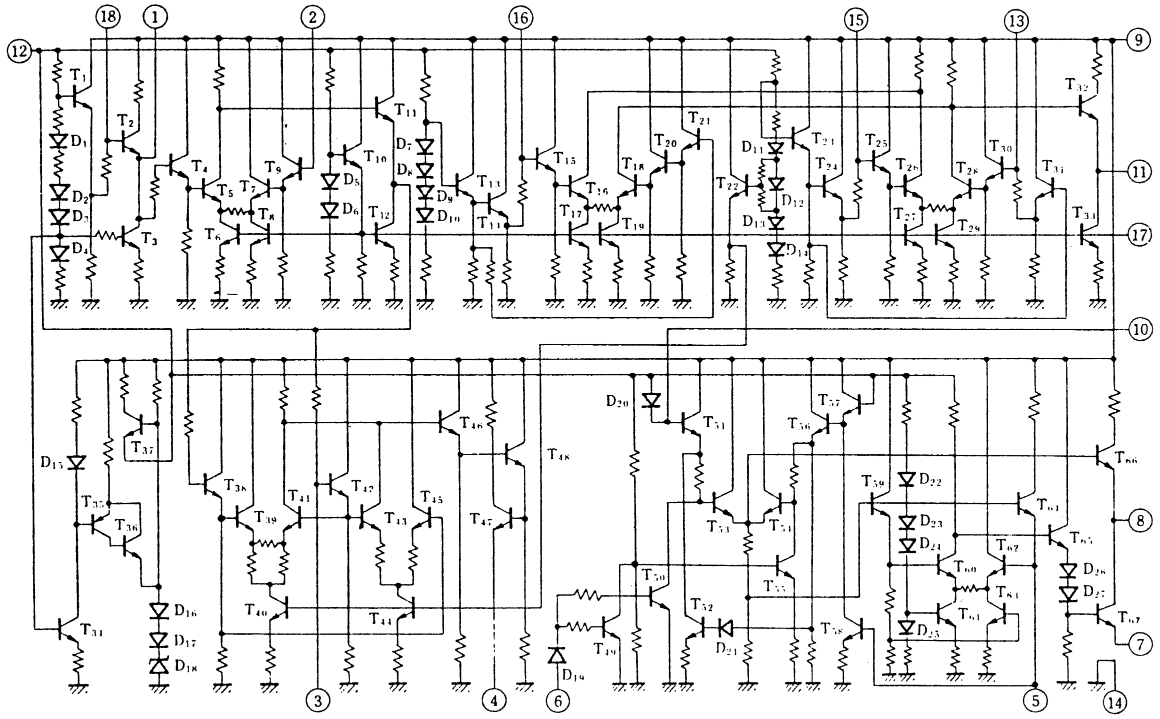
AGC Amp.
AGC Bias
Amp.
AGC Detector
Pre-emphasis
Voltage Stabilizer
Clamp
White Clip
10
9
7
6
3
2
1
15
16
11
14
4
5
8
12
13



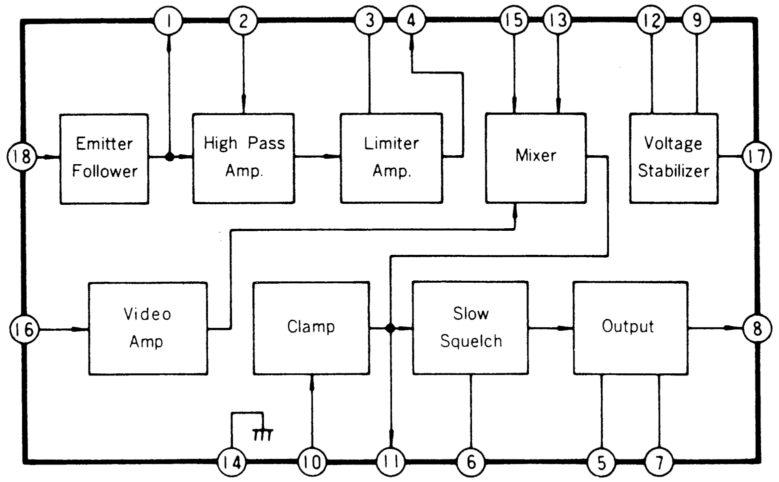
1
2
3
4
5
6
7
8
16
15
14
13
12
11
10
9

– AN303 –

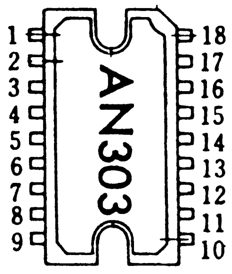
IC5 of Y/C Board



⑱
①
②
⑯
⑮
⑬
⑫
⑨
⑪
⑰
⑩
⑧
⑦
③
④
⑥
⑤
⑭



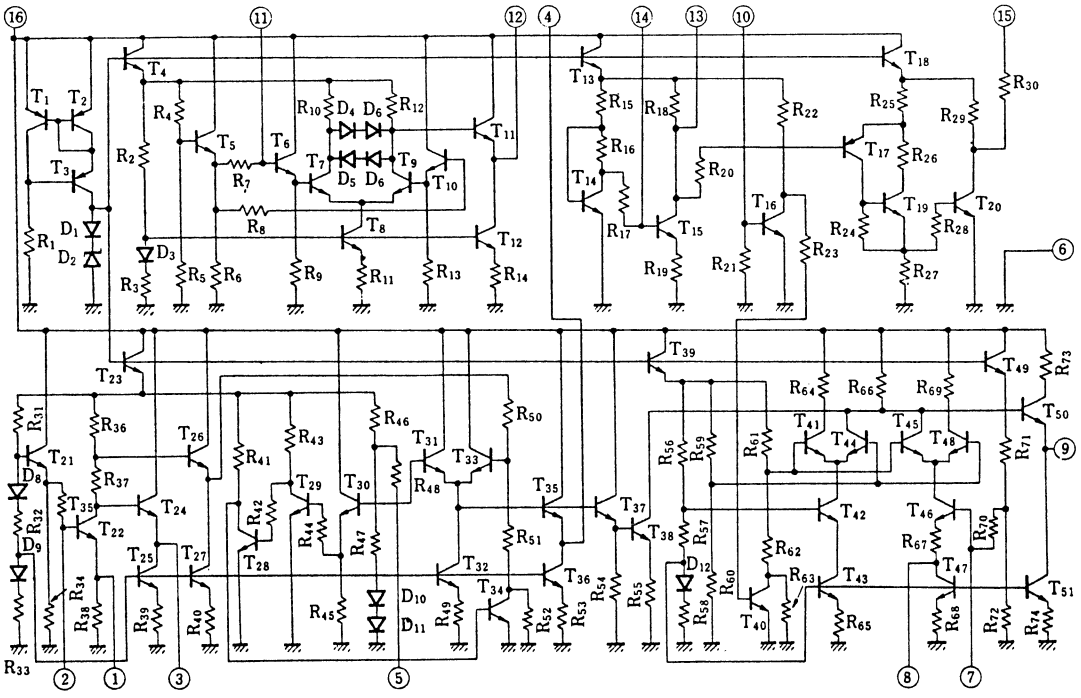
Emitter Follower
High Pass Amp.
Limiter Amp.
Mixer
Voltage Stabilizer
Video Amp
Clamp
Slow Squelch
Output
1
2
3
4
15
13
12
9
18
17
16
8
14
10
11
6
5
7

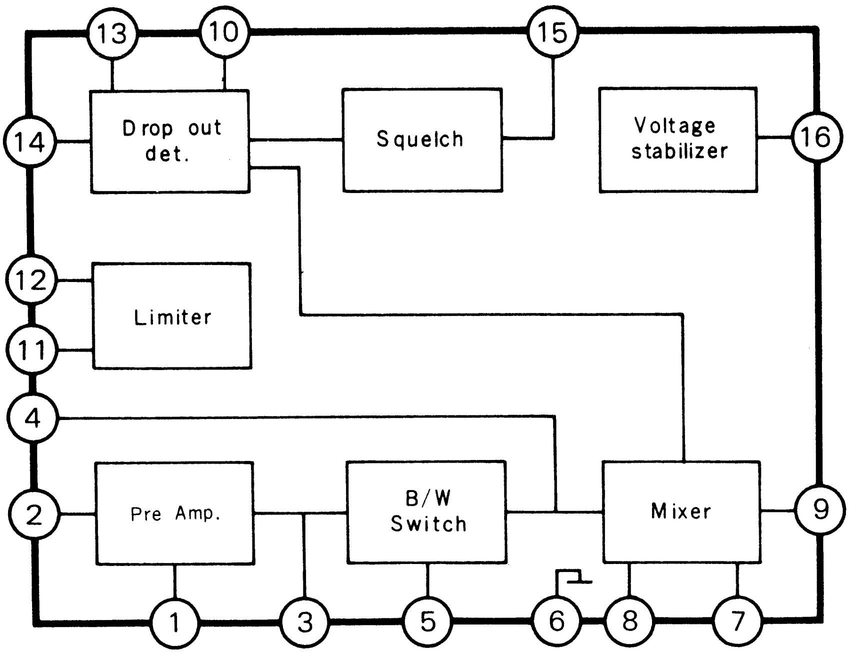


AN303
1
2
3
4
5
6
7
8
9
18
17
16
15
14
13
12
11
10

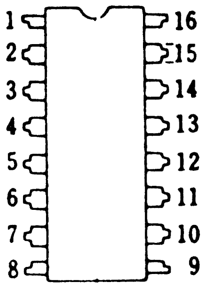
— AN316 —

IC4 of Y/C Board





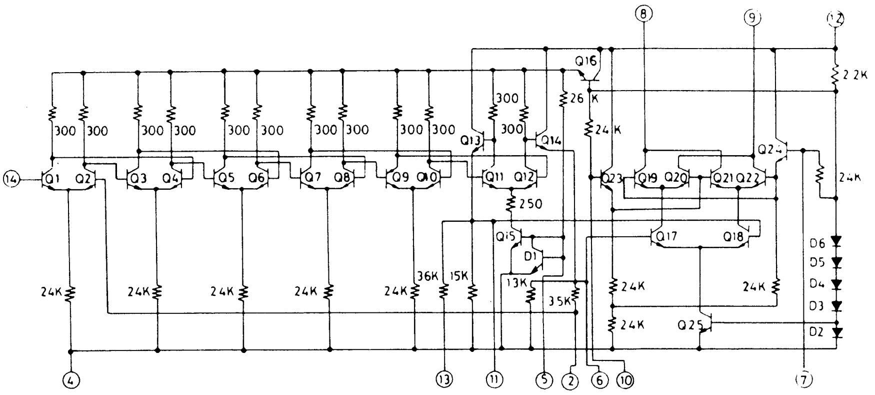
Drop out det.
Squelch
Voltage stabilizer
Limiter
Pre Amp.
B/W Switch
Mixer
13
10
15
14
16
12
11
4
2
9
1
3
5
6
8
7



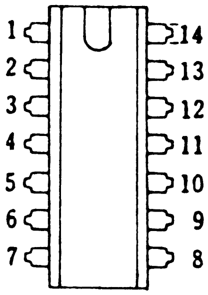
1
2
3
4
5
6
7
8
16
15
14
13
12
11
10
9

– SN76670N –

IC7 and 9 of Y/C Board



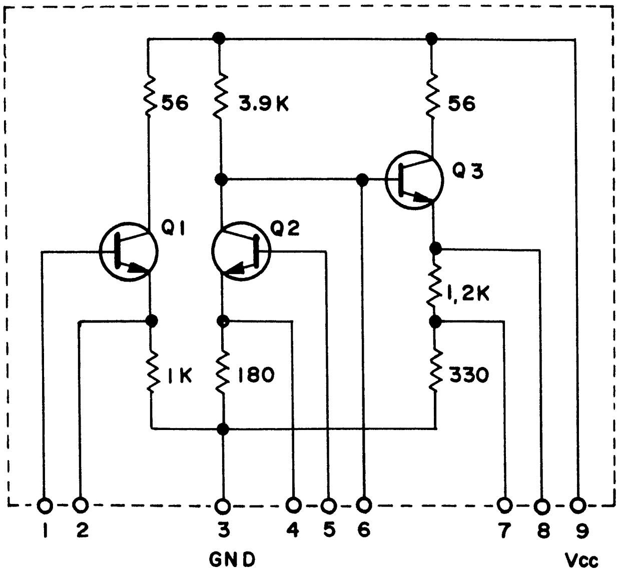
⑭
④
⑧
⑨
⑫
⑬
⑪
⑤
②
⑥
⑩
⑦
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Q14
Q15
Q16
Q17
Q18
Q19
Q20
Q21
Q22
Q23
Q24
Q25
D1
D2
D3
D4
D5
D6
300
250
24K
36K
15K
13K
35K
26K
2.2K



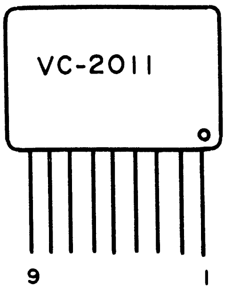
1
2
3
4
5
6
7
14
13
12
11
10
9
8

– VC2011M –

IC8 and IC201 of Y/C Board

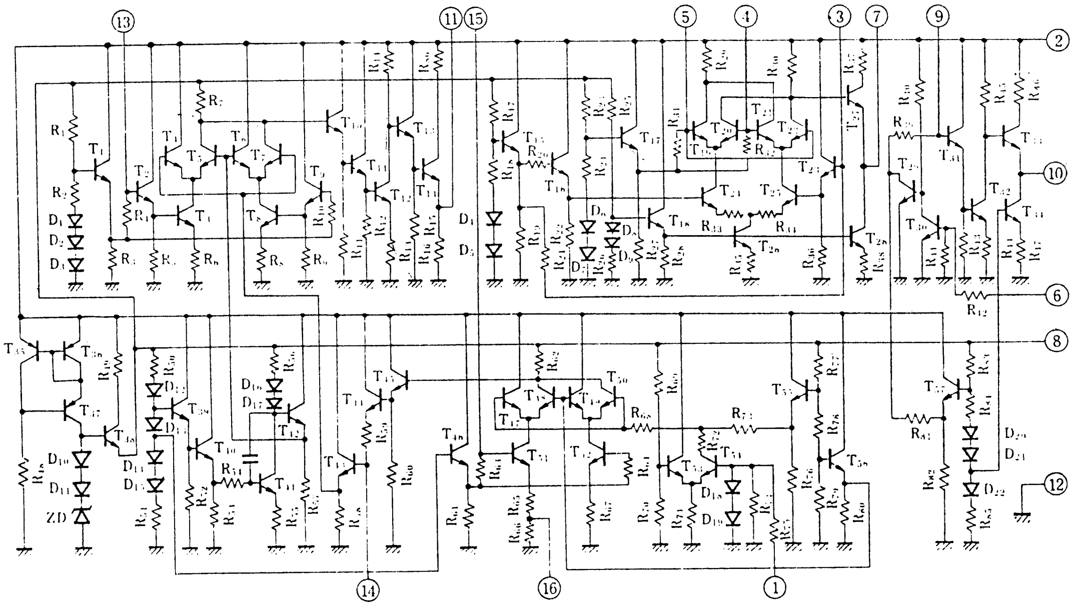


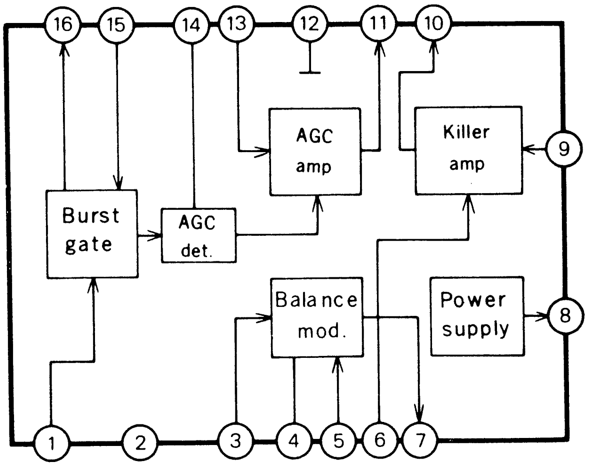
56
3.9K
56
Q3
Q1
Q2
1,2K
1K
180
330
1
2
3
4
5
6
7
8
9
GND
Vcc

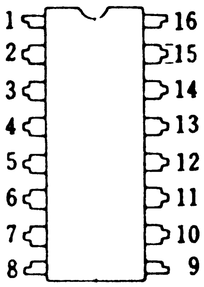


— AN305 —

IC202 of Y/C Board

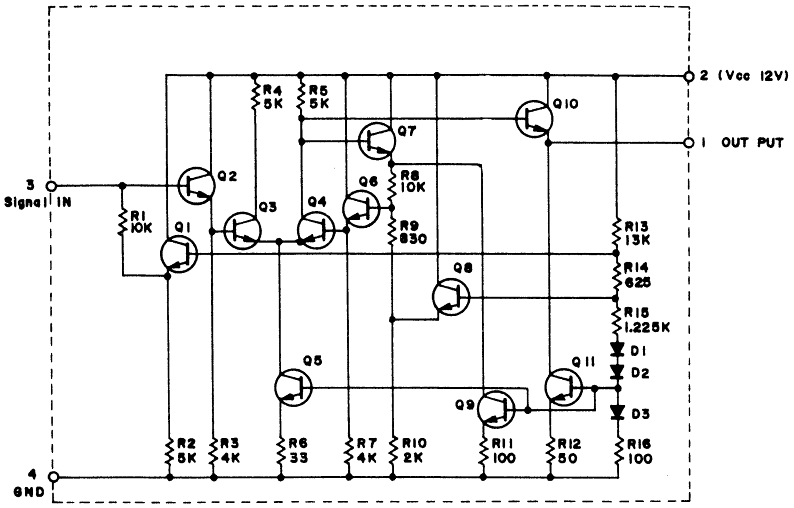



16
15
14
13
12
11
10
AGC amp
Killer amp
Burst gate
AGC det.
Balance mod.
Power supply
9
8
1
2
3
4
5
6
7

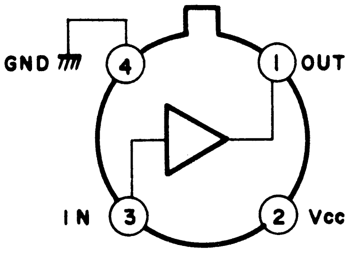

1
2
3
4
5
6
7
8
16
15
14
13
12
11
10
9

— AN608 —

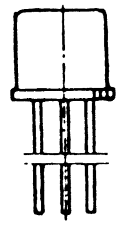
IC203 of Y/C Board

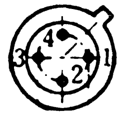


2 (Vcc 12V)
1 OUT PUT
3 Signal IN
4 GND
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
R1 10K
R2 5K
R3 4K
R4 5K
R5 5K
R6 33
R7 4K
R8 10K
R9 830
R10 2K
R11 100
R12 50
R13 13K
R14 625
R15 1.225K
R16 100
D1
D2
D3



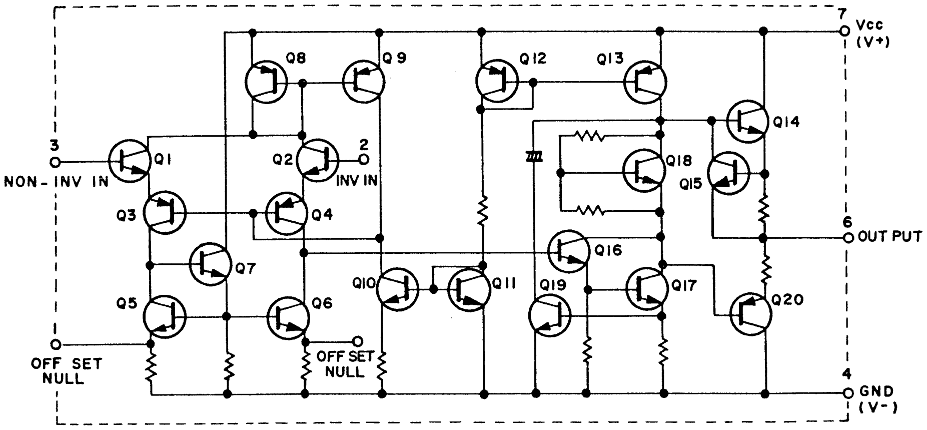
GND
4
1
OUT
IN
3
2
Vcc



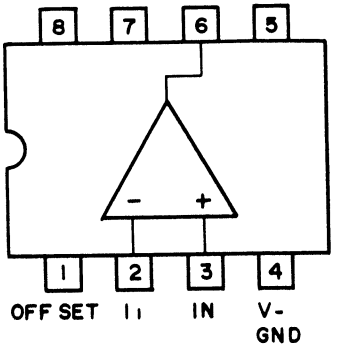


— UA741TC —

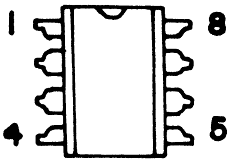
IC205 and IC206 of Y/C Board



7 Vcc (V+)
3 NON-INV IN
2 INV IN
6 OUT PUT
4 GND (V-)
OFF SET NULL
1
OFF SET NULL
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Q14
Q15
Q16
Q17
Q18
Q19
Q20

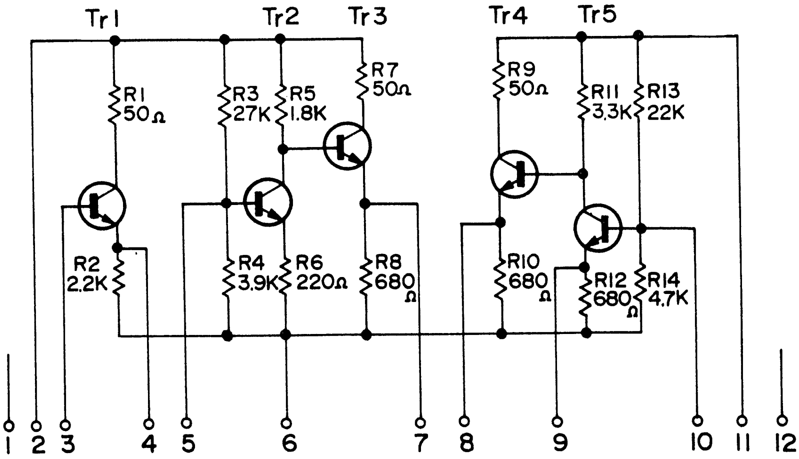


NC
V+
OUT
OFF SET
8
7
6
5
-
+
1
2
3
4
OFF SET
I I
IN
V-
GND

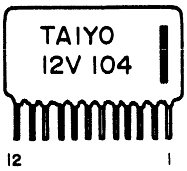


— 12V104 —

IC2 of Y/C Board



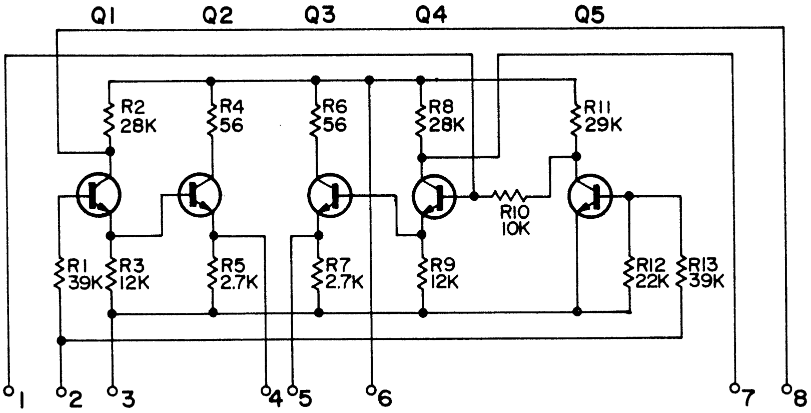
Tr1
Tr2
Tr3
Tr4
Tr5
R1 50Ω
R2 2.2K
R3 27K
R4 3.9K
R5 1.8K
R6 220Ω
R7 50Ω
R8 680Ω
R9 50Ω
R10 680Ω
R11 3.3K
R12 680Ω
R13 22K
R14 4.7K
1
2
3
4
5
6
7
8
9
10
11
12



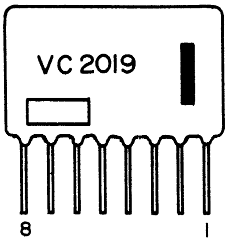
TAIYO
12V 104
12
1

— VC2019 —

IC3 of Y/C Board

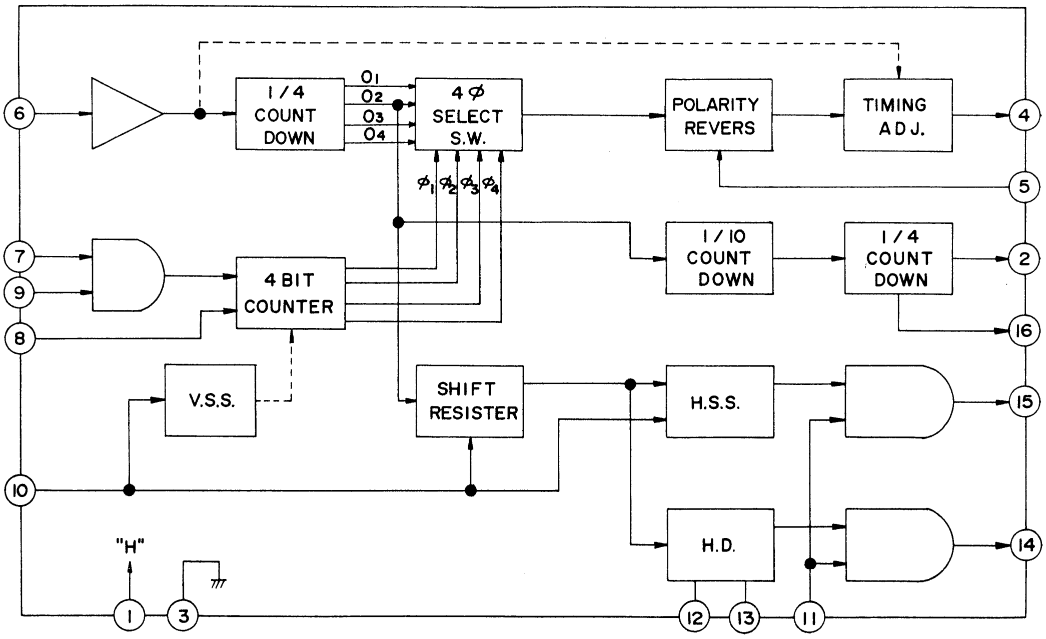


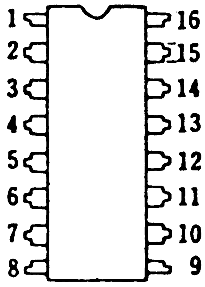
Q1
Q2
Q3
Q4
Q5
R1 39K
R2 28K
R3 12K
R4 56
R5 2.7K
R6 56
R7 2.7K
R8 28K
R9 12K
R10 10K
R11 29K
R12 22K
R13 39K
1
2
3
4
5
6
7
8



— MN6061A —

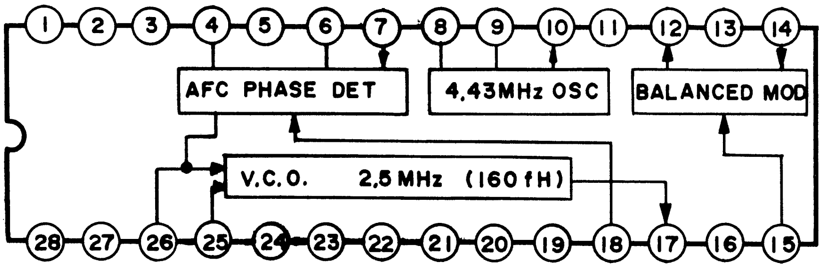
IC207 of Y/C Board


1/4 COUNT DOWN
O1
O2
O3
O4
4Φ SELECT S.W.
Φ1 Φ2 Φ3 Φ4
POLARITY REVERS
TIMING ADJ.
1/10 COUNT DOWN
1/4 COUNT DOWN
4 BIT COUNTER
V.S.S.
SHIFT RESISTER
H.S.S.
H.D.
"H"
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

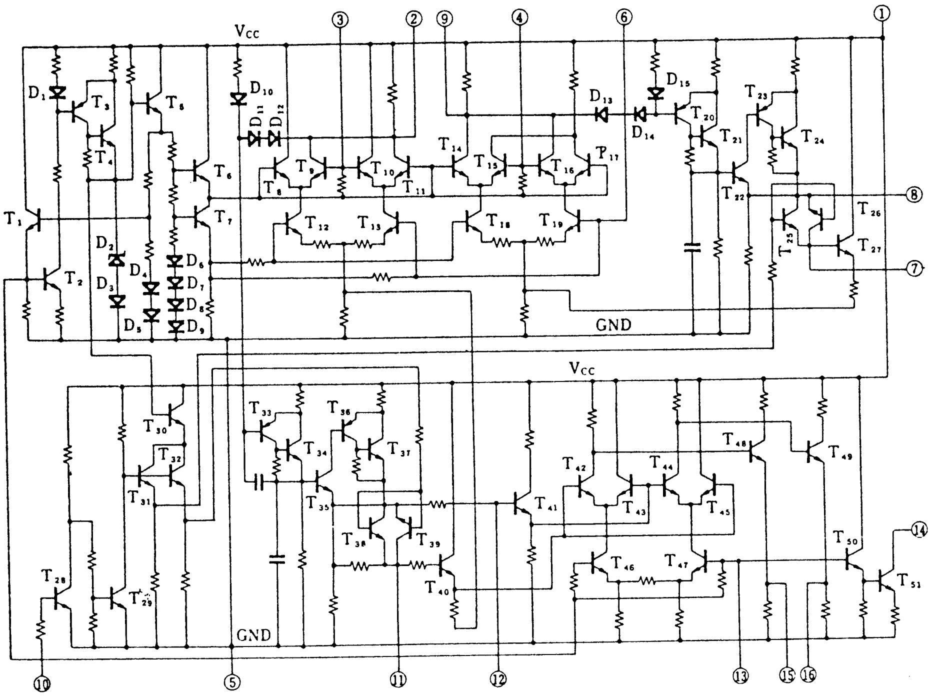
— AN337 —

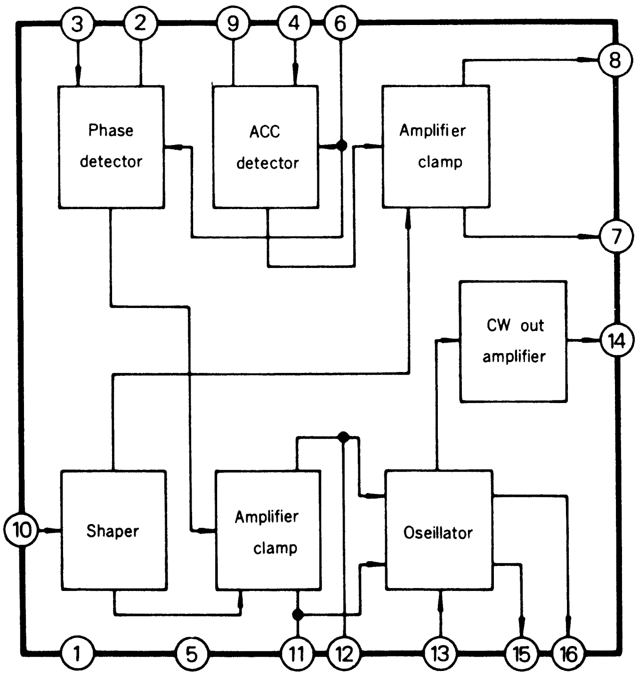
IC208 of Y/C Board

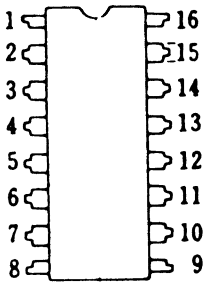

AFC PHASE DET
4.43MHz OSC
BALANCED MOD
V.C.O. 2.5 MHz (160 fH)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28

— AN236 —

IC204 of Y/C Board

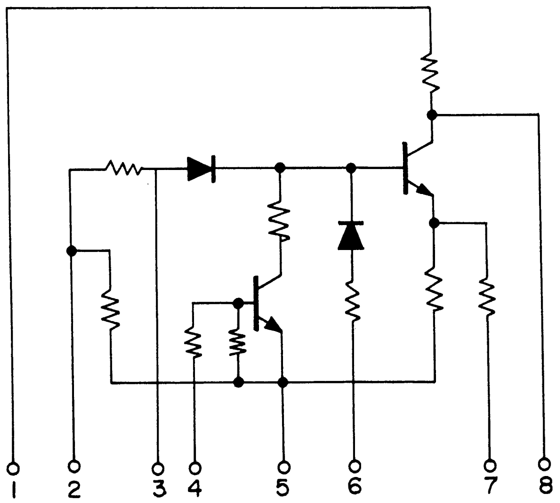

Vcc
GND
Vcc
GND
①
②
③
④
⑤
⑥
⑦
⑧
⑨
⑩
⑪
⑫
⑬
⑭
⑮
⑯
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
T13
T14
T15
T16
T17
T18
T19
T20
T21
T22
T23
T24
T25
T26
T27
T28
T29
T30
T31
T32
T33
T34
T35
T36
T37
T38
T39
T40
T41
T42
T43
T44
T45
T46
T47
T48
T49
T50
T51
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15

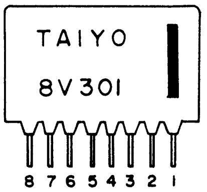

3
2
9
4
6
8
7
14
10
1
5
11
12
13
15
16
Phase detector
ACC detector
Amplifier clamp
CW out amplifier
Shaper
Amplifier clamp
Oseillator


1
2
3
4
5
6
7
8
16
15
14
13
12
11
10
9

– 8V301 –

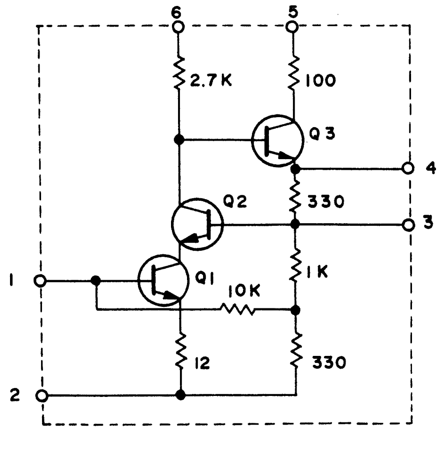
IC6 of Y/C Board

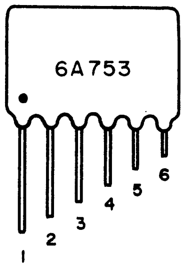



TAIYO
8V301
8 7 6 5 4 3 2 1

– 6A753 –

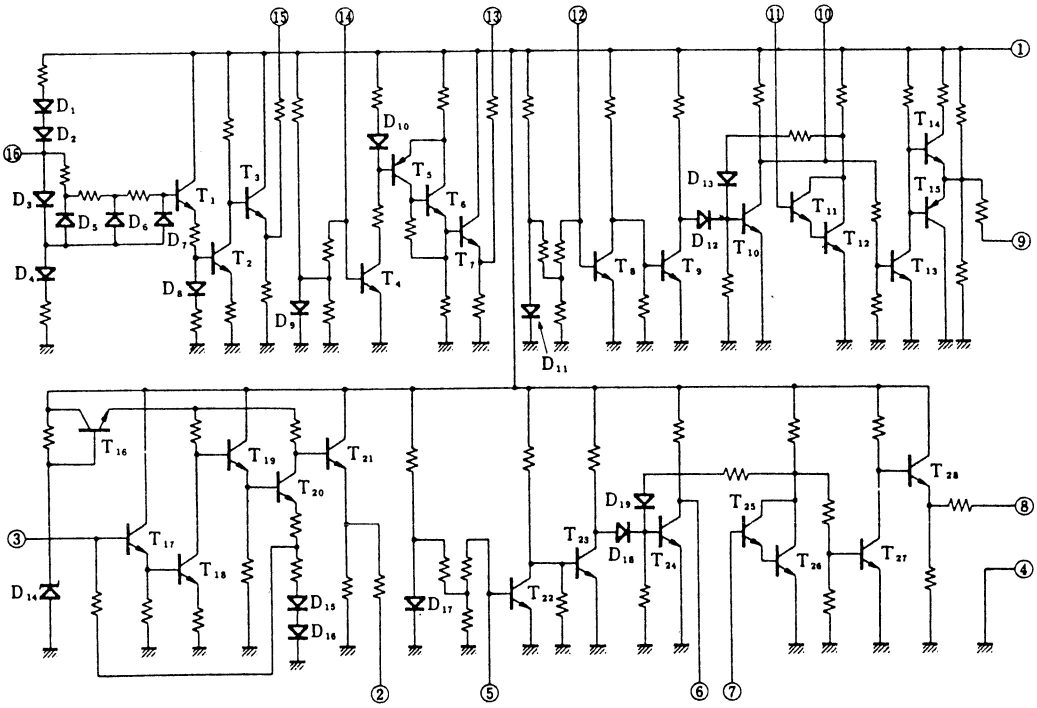
IC 1, 2 of PRE/REC Board.


6
5
2.7K
100
Q3
4
Q2
330
3
1
Q1
10K
1K
12
330
2

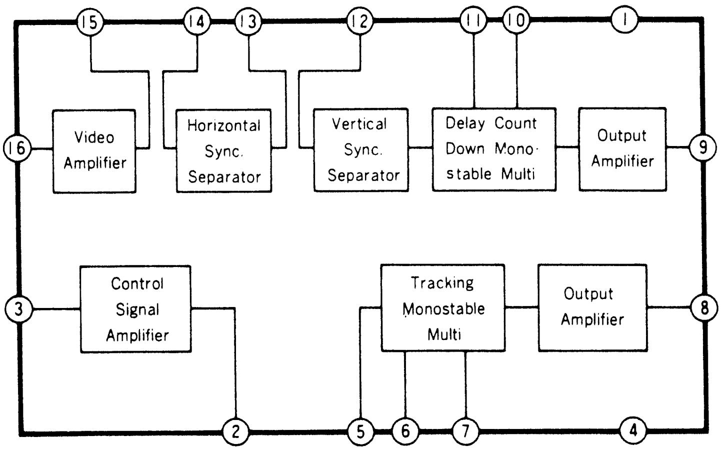

6A753
1
2
3
4
5
6

— AN301 —

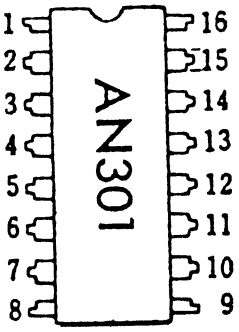
IC 1 of Audio/Servo Board.



15
14
13
12
11
10
1
16
9
8
4
3
2
5
6
7
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15
D16
D17
D18
D19
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
T13
T14
T15
T16
T17
T18
T19
T20
T21
T22
T23
T24
T25
T26
T27
T28



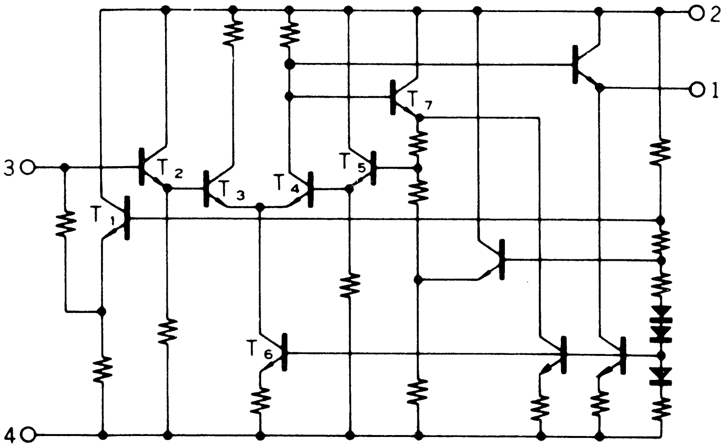
15
14
13
12
11
10
1
16
Video Amplifier
Horizontal Sync. Separator
Vertical Sync. Separator
Delay Count Down Monostable Multi
Output Amplifier
9
3
Control Signal Amplifier
Tracking Monostable Multi
Output Amplifier
8
2
5
6
7
4

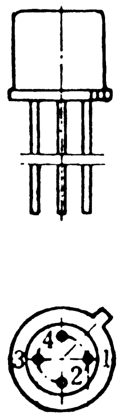


AN301
1
2
3
4
5
6
7
8
16
15
14
13
12
11
10
9

– AN608 –

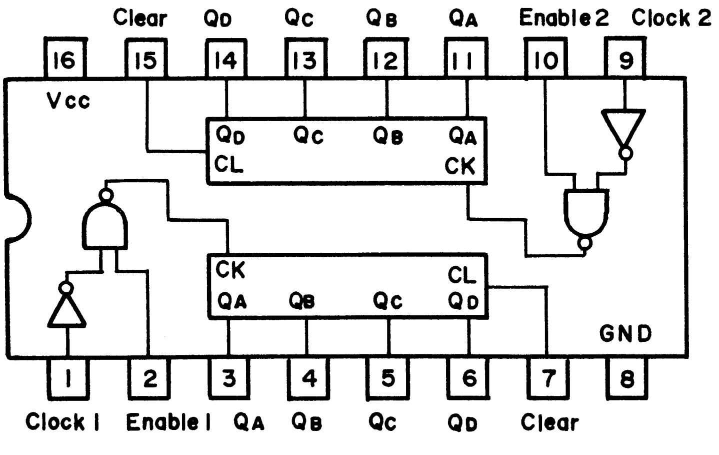
IC 2 of Audio/Servo Board.

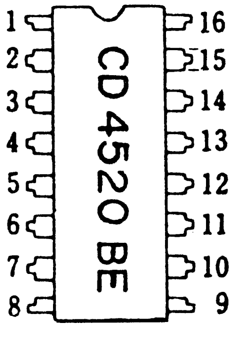

2
1
3
4
T1
T2
T3
T4
T5
T6
T7



– CD4520BE –

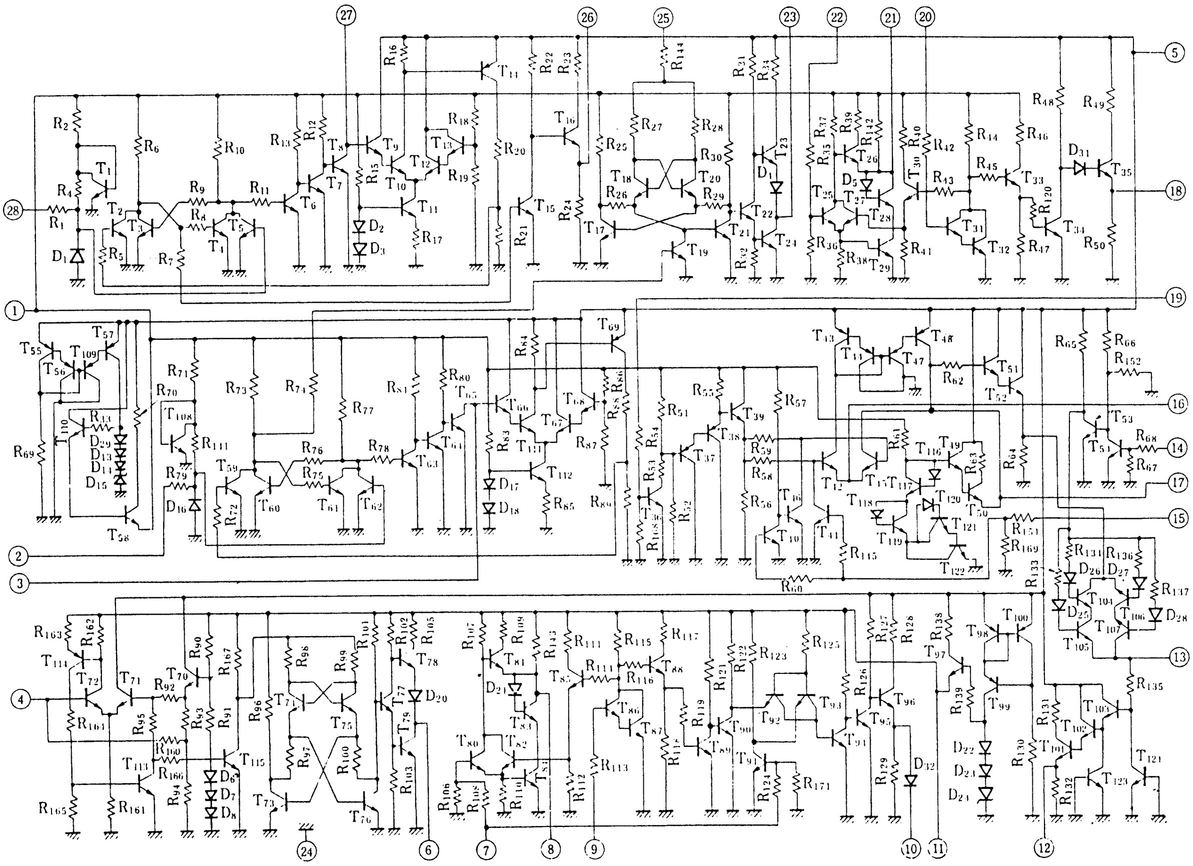
IC 4 of Audio/Servo Board.


Clear
QD
QC
QB
QA
Enable 2
Clock 2
16
15
14
13
12
11
10
9
Vcc
QD
QC
QB
QA
CL
CK
CK
CL
QA
QB
QC
QD
GND
1
2
3
4
5
6
7
8
Clock I
Enable I
QA
QB
QC
QD
Clear

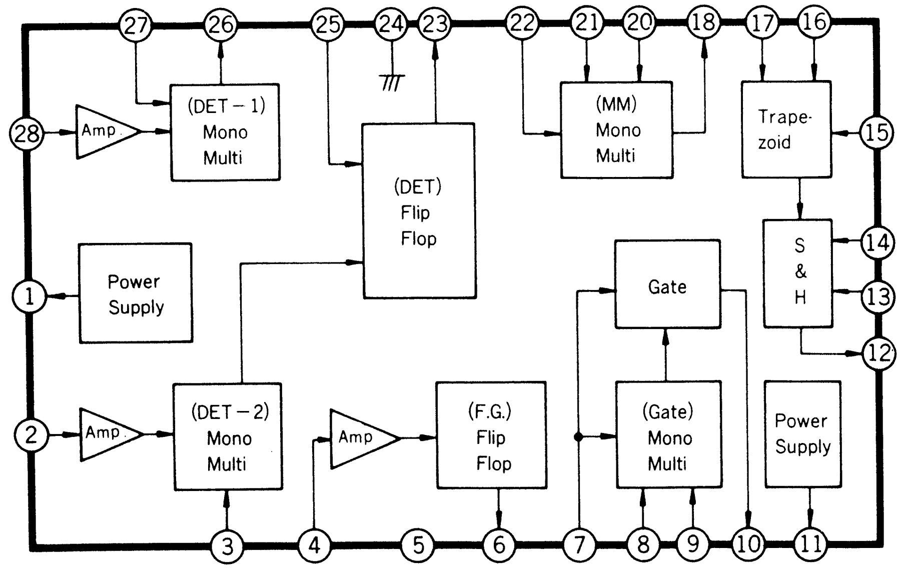

CD 4520 BE
1
2
3
4
5
6
7
8
16
15
14
13
12
11
10
9

— AN318 —

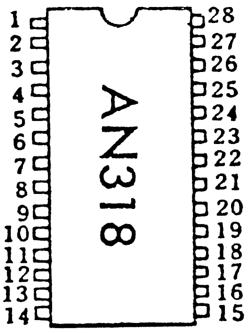
IC 3 of Audio/Servo Board.



27
26
25
23
22
21
20
5
18
28
1
19
16
14
17
15
2
3
13
4
24
6
7
8
9
10
11
12



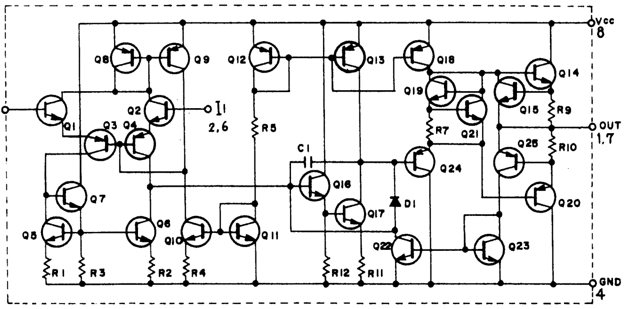
27
26
25
24
23
22
21
20
18
17
16
28
Amp
(DET – 1)
Mono
Multi
(DET)
Flip
Flop
(MM)
Mono
Multi
Trape-
zoid
15
1
Power
Supply
Gate
S
&
H
14
13
12
2
Amp
(DET – 2)
Mono
Multi
Amp
(F.G.)
Flip
Flop
(Gate)
Mono
Multi
Power
Supply
3
4
5
6
7
8
9
10
11

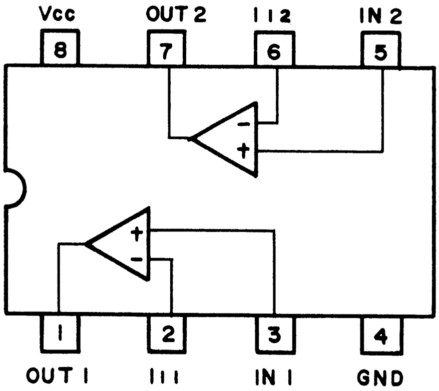


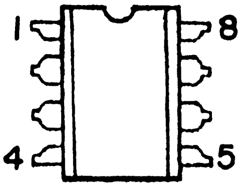
AN318
1
2
3
4
5
6
7
8
9
10
11
12
13
14
28
27
26
25
24
23
22
21
20
19
18
17
16
15

– UPC1458C –

IC 5 of Audio/Servo Board.

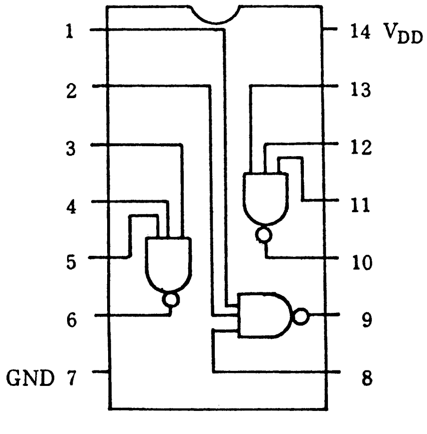

Vcc
8
Q8
Q9
Q12
Q13
Q18
Q14
Q19
Q15
R9
IN
3,5
Q1
Q2
I1
2,6
Q3
Q4
R5
R7
Q21
OUT
1,7
Q25
R10
C1
Q24
Q16
Q7
D1
Q17
Q20
Q5
Q6
Q10
Q11
Q22
Q23
R1
R3
R2
R4
R12
R11
GND
4


Vcc
OUT 2
I I2
IN 2
8
7
6
5
-
+
+
-
1
2
3
4
OUT I
I I I
IN I
GND



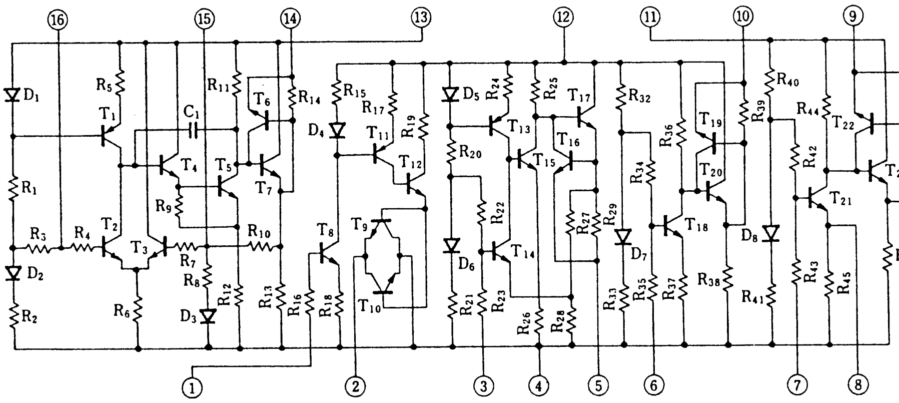
– MSM4023, CD4023AE –

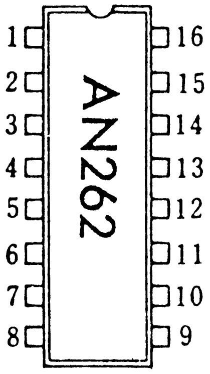
IC 2 and IC 4 of Mechanism control Board.


1
2
3
4
5
6
GND 7
14 V_{DD}
13
12
11
10
9
8

– AN262 –

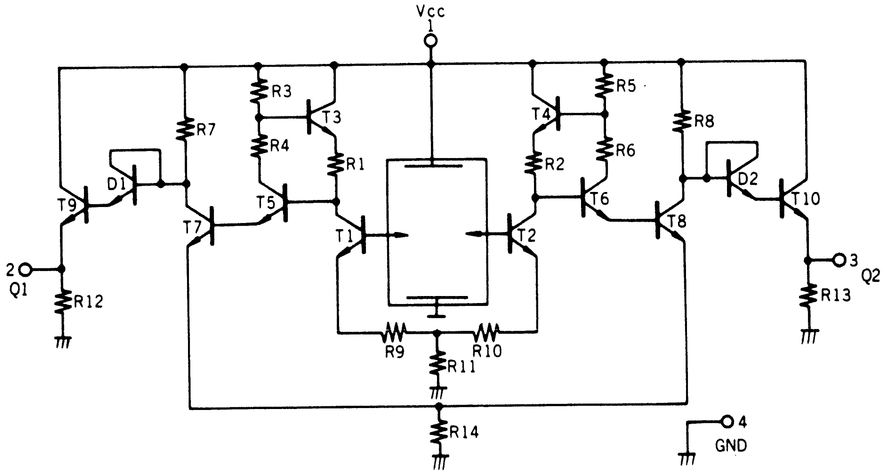
IC 6 of Audio/Servo Board.

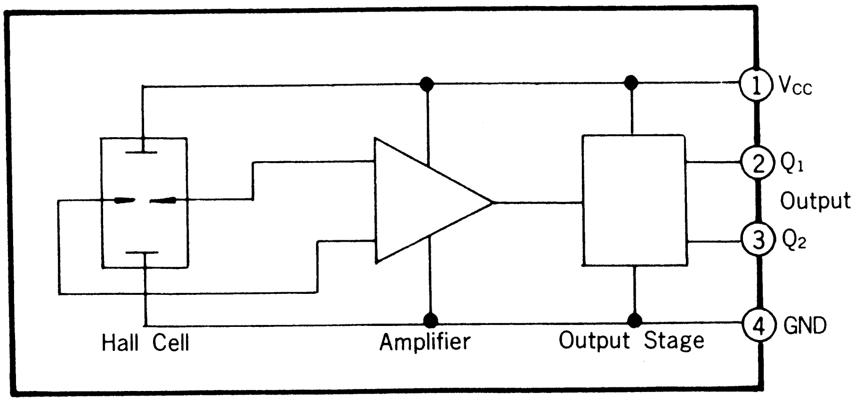

⑯
⑮
⑭
⑬
⑫
⑪
⑩
⑨
D₁
R₅
T₁
C₁
R₁₁
T₆
R₁₄
R₁₅
R₁₇
D₄
T₁₁
R₁₉
T₁₂
D₅
R₂₄
R₂₅
T₁₇
R₃₂
T₁₃
T₁₆
T₁₅
R₂₀
R₃₆
T₁₉
R₃₉
R₄₀
R₄₄
T₂₂
R₄₇
T₄
T₅
T₇
R₉
R₁
R₃
R₄
T₂
T₃
R₇
R₁₀
T₈
T₉
T₁₀
R₂₂
T₁₄
D₆
R₂₇
R₂₉
D₇
R₃₄
T₁₈
T₂₀
D₈
R₄₂
T₂₁
T₂₃
R₄₆
D₂
R₂
R₆
R₈
D₃
R₁₂
R₁₃
R₁₆
R₁₈
R₂₁
R₂₃
R₂₆
R₂₈
R₃₃
R₃₅
R₃₇
R₃₈
R₄₁
R₄₃
R₄₅
①
②
③
④
⑤
⑥
⑦
⑧

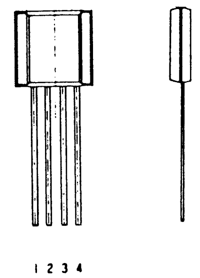

AN262
1
2
3
4
5
6
7
8
16
15
14
13
12
11
10
9

– DN835 –

Take-up reel disk sensor.

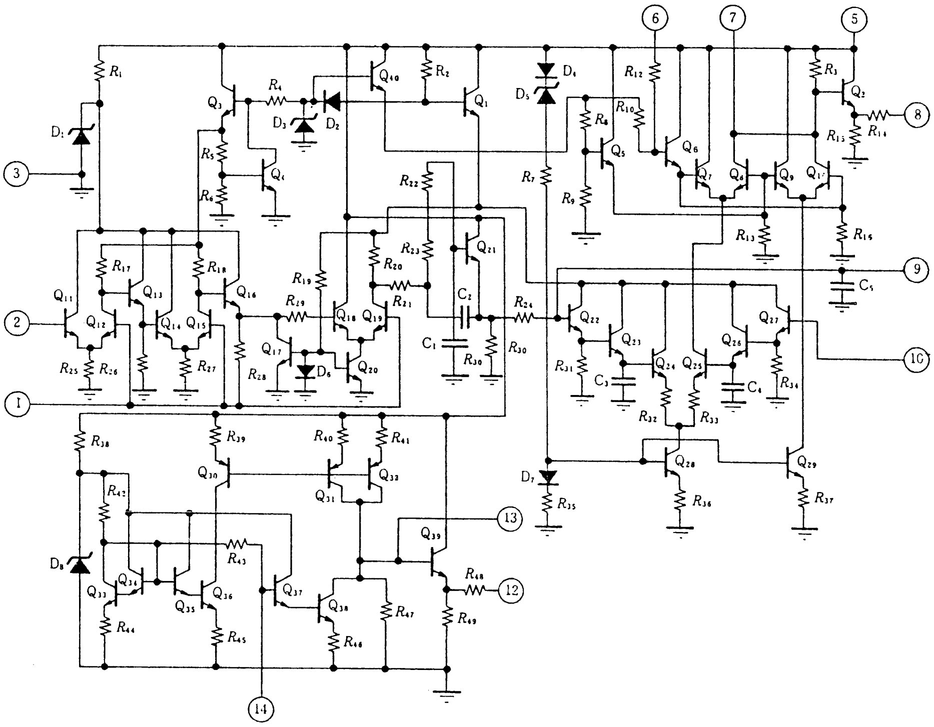

Vcc
1
R3
T3
R4
R1
R7
D1
T9
T7
T5
T1
R5
R6
R8
T4
R2
T6
T2
T8
D2
T10
2
Q1
R12
3
Q2
R13
R9
R10
R11
R14
4
GND

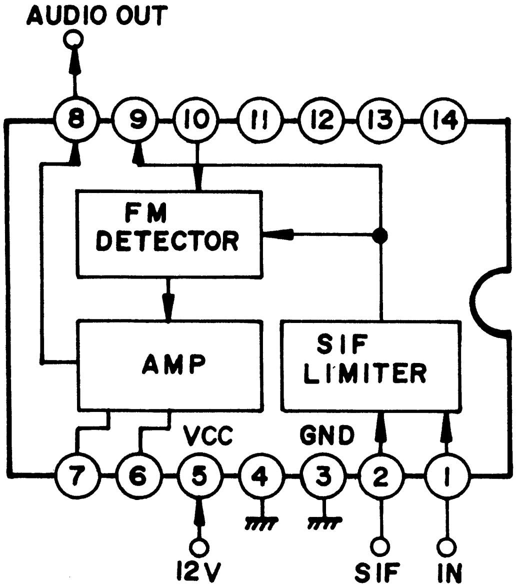

1
Vcc
2
Q₁
Output
3
Q₂
4
GND
Hall Cell
Amplifier
Output Stage

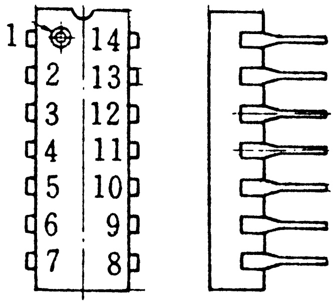


– HA1154 –

IC 501 of Tuner Board.

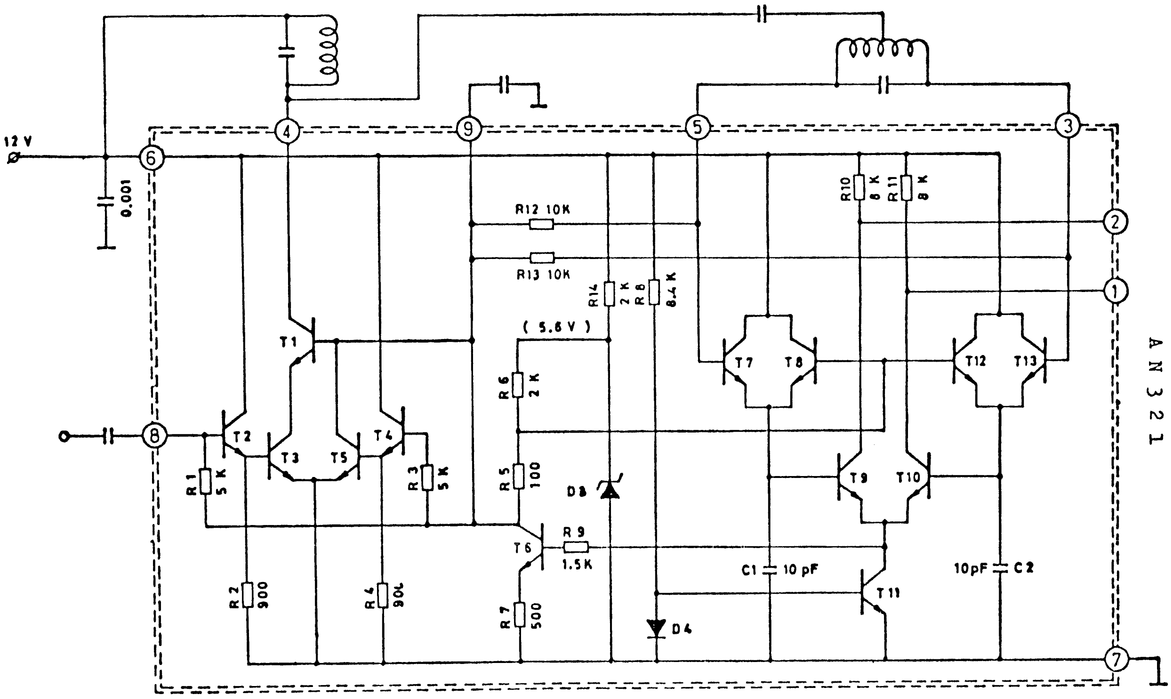

6
7
5
8
3
2
I
9
10
13
12
14
R₁
R₂
R₃
R₄
R₅
R₆
R₇
R₈
R₉
R₁₀
R₁₁
R₁₂
R₁₃
R₁₄
R₁₅
D₁
D₂
D₃
D₄
D₅
D₆
D₇
D₈
Q₁
Q₂
Q₃
Q₄
Q₅
Q₆
Q₇
Q₈
Q₉
Q₁₀
Q₁₁
Q₁₂
Q₁₃
Q₁₄
Q₁₅
Q₁₆
Q₁₇
Q₁₈
Q₁₉
Q₂₀
Q₂₁
Q₂₂
Q₂₃
Q₂₄
Q₂₅
Q₂₆
Q₂₇
Q₂₈
Q₂₉
Q₃₀
Q₃₁
Q₃₂
Q₃₃
Q₃₄
Q₃₅
Q₃₆
Q₃₇
Q₃₈
Q₃₉
C₁
C₂
C₃
C₄
C₅
R₁₇
R₁₈
R₁₉
R₂₀
R₂₁
R₂₂
R₂₃
R₂₄
R₂₅
R₂₆
R₂₇
R₂₈
R₃₀
R₃₁
R₃₂
R₃₃
R₃₄
R₃₅
R₃₆
R₃₇
R₃₈
R₃₉
R₄₀
R₄₁
R₄₂
R₄₃
R₄₄
R₄₅
R₄₆
R₄₇
R₄₈
R₄₉

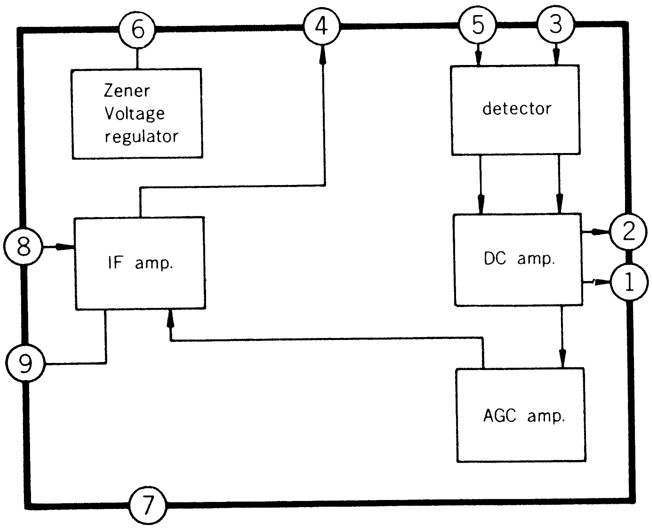

AUDIO OUT
8
9
10
11
12
13
14
FM DETECTOR
AMP
SIF LIMITER
VCC
GND
7
6
5
4
3
2
1
12V
SIF
IN

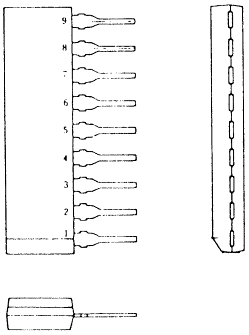

1
14
2
13
3
12
4
11
5
10
6
9
7
8

— AN321 —

IC 401 of Tuner Board.


12 V
0.001
6
4
9
5
3
2
1
8
7
R12 10K
R13 10K
R14 2 K
R8 8.4 K
R10 8 K
R11 8 K
(5.6 V)
T1
T2
T3
T5
T4
T6
T7
T8
T9
T10
T11
T12
T13
R1 5 K
R3 5 K
R6 2 K
R5 100
D3
R9 1.5K
R2 900
R4 90K
R7 500
D4
C1 10 pF
10pF C2
A N 3 2 1


6
4
5
3
Zener Voltage regulator
detector
8
IF amp.
DC amp.
2
1
9
AGC amp.
7



SECTION 11
ELECTRICAL PARTS LIST BY ASSEMBLIES

1. All abbreviations in this list are as follows:

   RESISTORS – All resistance values are in ohms (Ω).

   K : 1 000
   M : 1 000 000
   CR : Carbon Resistor
   Comp. R : Composition Resistor
   WR : Wire Wound Resistor
   OMR : Oxide Metal Film Resistor
   VR : Variable Resistor
   MFR : Metal Film Resistor

   CAPACITORS – All capacitance values are in μF, unless otherwise indicated.

   P : μμF
   C Cap : Ceramic Capacitor
   PS Cap : Polystyrol Capacitor
   MY Cap : Mylar Capacitor
   MP Cap : Metalized Paper Capacitor
   PC Cap : Polycarbonate Capacitor
   E Cap : Electrolytic Capacitor
   PP Cap : Poly Pro Capacitor
   MM Cap : Metalized Mylar Capacitor
   T Cap : Tantalum Capacitor
   NP Cap : Non-Polar Capacitor

   Tolerance of resistors and capacitors is as follows:

   M : ± 20%
   K : ± 10%
   J : ± 5%
   G : ± 2%

2. Carbon resistors in ohm, 1/2 W, 1/4 W, 1/8 W, ±10% are not listed.
3. Standard electrolytic capacitors (less than 1 000 μF), mylar capacitors (less than 100 V) and ceramic capacitors (less than 50 V) are not listed.

11-1 LUMINANCE/CHROMINANCE (Y/C) PRINTED BOARD ASS'Y .... PU46075A for (EG) PU46075B for (EK)

Symbol No.	Part No.	Part Name	Description
IC 1	AN302	Integrated Circuit	
IC 2	12V104	"	
IC 3	VC2019	"	
IC 4	AN316	"	
IC 5	AN303	"	
IC 6	8V301	"	
IC 7	SN76670N	"	
IC 8	VC2011M	"	
IC 9	SN76670N	"	
IC201	VC2011M	"	
IC202	AN305	"	
IC203	AN608	"	
IC204	AN236	"	
IC205	UPC741C	"	
IC206	UPC741C	"	
IC207	MN6061A	"	
IC208	AN1337	"	
X 1	2SC829C	Transistor	
X 2	2SK40C	FET	
X 3	2SC829C	Transistor	
X 4	"	"	
X 5	"	"	
X 6	"	"	
X 7	"	"	
X 8	"	"	
X 9	2SA546Q	"	
X10	2SC829C	"	
X201	2SK40C	FET	
X202	2SC829C	Transistor	
X203	"	"	
X204	"	"	
X205	33K49Q	MOS FET	
X206	2SA564Q	Transistor	
X207	"	"	
X208	2SA719R	"	
X209	2SC829C	"	
X210	"	"	
X211	"	"	
X212	2SA719R	"	
X213	2SC829C	"	
X214	2SC1214AB	"	
X215	2SC829C	"	
X216	"	"	
X217	2SA564Q	"	
X218	2SC829C	"	
X219	"	"	
X220	2SA564Q	"	
D 1	0A90	Diode	
D 2	MA150LF	"	
D 3	"	"	
D 4	"	"	
D 5	0A90	"	
D 6	"	"	
D 7	"	"	

Symbol No.	Part No.	Part Name	Description
D 8	0A90	Diode	
D 9	"	"	
D10	MA150LF	"	
D11	"	"	
D12	0A91	"	
D201	MA150LF	"	
D202	"	"	
D203	"	"	
D204	"	"	
D205	"	"	
D206	"	"	
D207	"	"	
D208	"	"	
D209	"	"	
D210	"	"	
D211	"	"	
D212	"	"	
D213	"	"	
D214	"	"	
D215	"	"	
D216	"	"	
D217	"	"	
D218	"	"	
D219	"	"	
D220	"	"	
R 4	QVP4A0B-103	VR	
R10	" -471	"	
R17	" -472	"	
R27	" -222	"	
R28	" -222	"	
R31	QRG126J-220	OMF R	
R45	QVP4A0B-222	VR	
R58	" -222	"	
R87	" -223	"	
R95	" -223	"	
R104	" -223	"	
R215	" -222	"	
R216	" -103	"	
R238	" -471	"	
R249	" -102	"	
R283	" -472	"	
R301	" -103	"	
R311	" -102	"	
R329	QRG126J-101	OMF R	
C 9	QEN41KM-106	N.P. Cap	
C54	" -106	"	
C247	QCT25UJ-330	C Cap	
C249	" -390	"	
C251	" -150	"	
C293	QCT25CH-101	"	
C294	QCT25UJ-100	"	
C295	QAT3001-010	Trimmer Cap	
C297	QCT25UJ-101	C Cap	
L 1	A04725-100	Peaking Coil	
L 2	" -56	"	
L 3	" -100	"	
L 4	" -18	"	
L 5	" -33	"	
L 6	–	–	
L 7	A04725-56	Peaking Coil	

Symbol No.	Part No.	Part Name	Description
L 8	A04725-220	Peaking Coil	
L 9	" -8.2	"	
L10	" -18	"	
L11	" -5.6	"	
L12	" -1	"	
L13	PU40010-101	Choke Coil	
L14	A04725-100	Peaking Coil	
L15	" -1200	"	
L16	" -47	"	
L17	" -100	"	
L18	" -100	"	
L19	" -100	"	
L201	A04096-8200	"	
L202	A04725-100	"	
L203	PU46003-3R9	"	
L204	A04725-100	"	
L205	PU30771-12	Coil	
L206	PU46003-6R8	Peaking Coil	
L207	A04725-100	"	
L208	" -39	"	
L209	PU46003-3R9	"	
L210	" -3R9	"	
L211	A04096-8200	"	
L212	A04725-100	"	
L213	A04096-8200	"	
L214	PU46003-6R8	"	
LPF1	PU30192-9D		
LPF2	PU30189-4		
LPF201	PU30192-1D		
BPF201	PU30190-6S		
BPF202	" -6S		
BPF203	PU46041		
HPF1	PU30487-4D		
DF 1	PU30773		
DL 1	PU43627C	1-H Delay Line	
DL201	PU43155-2	Delay Equalizer	
DL202	PU46321-2	2-H Delay Line	
CT201	PU46042	Ceramic Trap	
CF201	A74603	Ceramic Filter	
X'tal 201	PU46040	4.435571 MHz	
X'tal 202	PU31449-2	4.433619 MHz	
	PU44711	Shield Case	
	PU44712	"	
	PU44713	"	
	PU46083	"	
	PU46084	"	
	PU46085	"	
	A74138-1	Pin	
	PU44706	Heat Sink	
	PU43351-3	Cap Housing	(91–93)(101–103)
	" -4	"	(81–84)
	" -6	"	(11–16)
	" -7	"	(21–27)

FM MODULATOR UNIT PU42697E

Symbol No.	Part No.	Part Name	Description
X 1	2N2369	Transistor	
X 2	"	"	
T 1	PU30769	FM Modulator Transformer	
C 1	PU30767-220	Feed through Cap	
C 2	QCT05CH-470	C Cap	
C 3	" -390	"	
C 4	QAT3001-011	Trimmer Cap	
C 5	PU30767-102	Feed through Cap	
C 7	PU30767-220	Feed through Cap	
R 1	QVP4A0B-102	VR	
L 1	A04096-100	Peaking Coil	
	PU42674	Shield Case	
	PU42675	"	
	PU42675-2	"	

11-2 PRE/RECORD (PRE/REC) PRINTED CIRCUIT BOARD ASS'Y PU46016C

Symbol No.	Part No.	Part Name	Description
IC 1	6A753	Integrated Circuit	
IC 2	"	"	
IC 3	18V103	"	
X 1	2SC829C	Transistor	
X 2	"	"	
X 3	2SA564Q	"	
X 4	2SA719R	"	
X 5	2SC1317R	"	
X 6	"	"	
X 7	2SA719R	"	
X 8	2SC1317R	"	
X 9	"	"	
X10	"	"	
X11	"	"	
X12	2SC829C	"	
X13	"	"	
X14	2SC1317R	"	
X15	2SA564Q	"	
D 1	0A91	Diode	
D 2	MA150LF	"	
D 3	"	"	
C18	QAT3001-009	Trimmer Cap	
C19	" -009	"	
R1	QVP4A0B-102	VR	
R2	" -102	"	
R17	QRX126J-100	MFR	
R20	" -4R7	"	
R21	" -4R7	"	
R24	QVP4A0B-101	VR	
R33	" -103	"	
R34	" -103	"	
R48	" -222	"	
R49	" -222	"	
R52	" -222	"	
R55	" -222	"	
LPF1	PU30192-1D	Low Pass Filter	
L 1	A04725-56	Peaking Coil	
L 2	" -100	"	
L 3	" -47	"	
L 4	" -47	"	
L 5	" -100	"	
L 6	" -820	"	
L 7	" -56	"	
	PU46013	Pre-amp. Shield Case	
	PU46014	"	
	PU46015	Pre-amp. Shield Case	
	PU43351-3	Cap Housing	(61–63)
	" -4	"	(21–24)
	" -5	"	(11–15)
	" -6	"	(31–36)

11-3 AUDIO/SERVO (A/S) PRINTED CIRCUIT BOARD ASS'Y PU44659B

Symbol No.	Part No.	Part Name	Description
IC 1	AN301(AN301A)	Integrated Circuit	
IC 2	AN608	"	
IC 3	AN318	"	
IC 4	UPD4520C	"	or CD4520BE
IC 5	UPC1458C	"	
IC 6	AN262	"	
X 1	2SD3890	Transistor	Power Transistor P.C. Board
X 2	"	"	
X 3	—	—	
X 4	2SA564Q	Transistor	
X 5	"	"	
X 6	2SC829C	"	
X 7	2SK40C	FET	
X 8	2SC829C	Transistor	
X 9	2SA673	"	
X10	2SC829C	"	
X11	2SA564Q	"	
X12	"	"	
X13	2SC829C	"	
X14	2SK40C	FET	
X15	2SC732BL	Transistor	
X16	"	"	
X17	2SC829C	"	
X18	"	"	
X19	"	"	
X20	"	"	
X21	"	"	
X22	"	"	
X23	"	"	
X24	"	"	
X25	"	"	
X26	2SC1162WTC	"	
X27	"	"	
D 1	—	—	
D 2	—	—	
D 3	MA150LF	Diode	
D 4	"	"	
D 5	"	"	
D 6	—	—	
D 7	MA150LF	Diode	
D 8	"	"	
D 9	"	"	
D10	"	"	
D11	"	"	
D12	"	"	
D13	"	"	
D14	"	"	
D15	2SC829C	Transistor	
D16	"	"	
D17	"	"	
D18	"	"	
D19	"	"	
D20	MA150LF	Diode	
D21	"	"	
D22	"	"	
D23	RD9.1EC	Zener Diode	
D24	MA150LF	Diode	
D25	"	"	
D26	"	"	
D27	"	"	

Symbol No.	Part No.	Part Name	Description
D28	—	—	
D29	—	—	
D30	—	—	
D31	RD3.9EC	Zener Diode	
D32	MA150LF	Diode	
D33	"	"	
D34	"	"	
D35	"	"	
D36	0A90	"	
D37	MA150LF	"	
D38	"	"	
D39	MA150	"	
C 6	QCS31HJ-680	C Cap	
C 7	" -471	"	
C13	" -101	"	
C29	QEE41AM-106	T Cap	
C32	QEE41CM-155	"	
C37	QCS31HJ-220	C Cap	
C50	QCS11HJ-101	"	
C54	QCS31HJ-561	"	
C61	" -391	"	
C63	" -681	"	
C79	" -561	"	
C80	QFP32XK-272	PP Cap	
C81	" -392	"	
C82	QEN41CA-475	NP Cap	
R 9	QVP4A0B-473	VR	
R22	" -224	"	
R29	" -473	"	
R33	" -473	"	
R39	TD5-C220	Thermistor	
R58	QVP4A0B-222	VR	
R74	" -222	"	
R76	" -223	"	
R111	" -472	"	
R113	PU44626	"	
R115	"	"	
R132	QVP4A0B-223	"	
R146	" -223	"	
R154	" -472	"	
R156	" -103	"	
R164	QRX126J-5R6	MFR	
R172	QRG126J-150	OMF R	
R173	" -150	"	
R174	QVP4A0B-473	VR	
TFC	PU44627-4	Tuning Fork	TFC(475.2 Hz)
S1	QSS9201-001	Slide Switch (S1)	
S2	QSS6201-201	" (S2)	
T 1	PU30961	Oscillator Transformer	
L 1	A04725-330	Peaking Coil	
L 2	PU30771-5	Coil	
L 3	A04725-1500	Peaking Coil	
	PU43351-3	Cap Housing	for Connector 3, 4,5,6,7,8,9,10 and 13

Symbol No.	Part No.	Part Name	Description
	PU43351-5	Cap Housing	for Connector 1
	" -7	"	for Connector 14
	" -9	"	for Connector 15
	" -103	"	for Connector 2
	" -106	"	for Connector 11

11-4 MECHANISM CONTROL PRINTED CIRCUIT BOARD PU44618A

Symbol No.	Part No.	Part Name	Description
IC 1	MSM401	Integrated Circuit	
IC 2	MSM4023	"	
IC 3	MSM401	"	
IC 4	CD4023UBE	"	
X 1	2SC829C	Transistor	
X 2	"	"	
X 3	"	"	
X 4	"	"	
X 5	"	"	
X 6	"	"	
X 7	2SC1213AD	"	
X 8	2SC1162WTC	"	
D 1	MA150LF	Diode	
D 2	"	"	
D 3	"	"	
D 4	"	"	
D 5	"	"	
D 6	"	"	
D 7	"	"	
D 8	"	"	
	PU43351-3	Cap. Housing	
	" -6	"	
	" -10	"	

11-5 TUNER PRINTED CIRCUIT BOARD ASS'Y .... VH1001A for (EG), VH1002A for (EK)

Symbol No.	Part No.	Part Name	Description
IC201	AN345	Integrated Circuit	
IC401	AN321	"	
IC501	HA1154	"	
X101	2SC1686V	Transistor	
X102	"	"	
X103	2SC1360	"	
X201	2SC1213A	"	
D201	1S2076	Diode	
R110	QRG129J-560	OMR	
R204	VVZ3230-023	VR	
R206	" -053	"	
R209	" -014	"	
R216	QRG019J-101	OMF R	
R401	QRG129J-680	OMR	
R504	QRG129J-390	"	
R505	QVZ3230-023	VR	
C101	QAT3001-010	Trimmer Cap	
C102	QCS31HJ-270	C Cap	
C104	QCT25HH-470	C Cap	
C105	2CT25LH-680	"	
C112	QCS31HJ-6R0	"	
C115	" -470	"	
C116	QAT3001-010	Trimmer Cap	
C118	QSC31HJ-270	C Cap	
C119	QCT25LH-680	"	
C121	QCS31HJ-100	"	
C122	" -5R0	"	
C123	QCT25RH-101	"	
C202	QEE50JM-686	T Cap	
C205	QCC31HJ-470	C Cap	
C206	" -100	"	
C211	" -100	"	
C212	" -270	"	
C401	QCF31HJ-3R0	"	
C402	" -470	"	
C408	QFC31HJ-470	"	
C409	QCT25LH-101	"	
C501	QSC31HJ-4R0	"	
C502	" -100	"	
C503	" -220	"	
C508	QCT25CH-150	"	
L101	A74979-R91	Peaking Coil	
L102	" -R91	"	
L103	A04725-8.2	"	
L104	" -1.8	"	
L105	" -2.2	"	
L201	A04725-47	"	
L401	" -1.8	"	
L402	" -1.8	"	
L403	" -2.2	"	
L501	" -12	"	
L502	" -6.8	"	
L503	" -1.8	"	
L504			
L505	" -5.6	"	

Symbol No.	Part No.	Part Name	Description
T101	A75217	Coupling Transformer	
T102	A75219	Sound Trap Transformer	
T103	A74657	"	
T104	A75084	3RD P. IF Transformer	
T105	A75085	Det. Transformer	
T106	A75086	Sound Trap Coil	
T107	A74762	5.5 MHz Trap Transformer	
T401	A75310	Coil	
T402	A75291	AFC Transformer	
T502	A75072	Transformer	(S. I. F.)
CF501	A75088	Ceramic Filter	
RFC01	QOL034K-101	RFC	
RFC02	" "	"	
CR101	A75205-221	CR Block	
CR102	" -221	"	
CR103	" -221	"	
DM101	A75116	Det. Module.	
DM501	A74664C	"	
P101	A75087	Piezonator	
	A74138-2	Tab	
	PU43351-3	Cap. Housing	
	" -4	"	
	" -6	"	
	PU44816	Rod Holder	
	C40189	Shield Case	
	C40190	Shield Bridge	
	C40191-2	Shield Top	
	C40192	Shield Bottom	
	C40193	Shield Case	
	C40194	Shield Bridge	
	C40195-2	Shield Top	
	C40196	Shield Bottom	

11-6 CH SELECTOR PRINTED CIRCUIT BOARD ASS'Y . . . . VH8001A for (EG) VH8002A for (EK)

Symbol No.	Part No.	Part Name	Description
IC91	UPC574J	Integrated Circuit	
X21	2SA673C	Transistor	
X22	2SC458C	"	
X23	"	"	
X24	"	"	
D 1	GL3PG2	LED	
D 2	"	"	
D 3	"	"	
D 4	"	"	
D 5	"	"	
D 6	"	"	
D 7	"	"	
D 8	"	"	
D 9	—	—	
D10	—	—	
D11	1S2473H	Diode	
D12	1S2473H	Diode	
D13	"	"	
D14	"	"	
D15	"	"	
D16	"	"	
D17	"	"	
D18	"	"	
D21	1S2473	"	
D22	"	"	
D23	"	"	
D24	"	"	
D25	"	"	
	AX49157	Push Lock SW Ass'y	
	PU43351-104	Cap Housing	
	" -105	"	
	" -106	"	

11-7 PRESETTER PRINTED CIRCUIT BOARD ASS'Y . . . . .VH8501A for (EG) VH8502A for (EK)

Symbol No.	Part No.	Part Name	Description
	A75450	P.M. Block Ass'y	
S51	QSM1S01-104	Microswitch	

11-8 REGULATOR PRINTED CIRCUIT BOARD ASS'Y. VH9001A

Symbol No.	Part No.	Part Name	Description
X 1	2SC1213AD	Transistor	
X 2	2SC828Q	"	
D 1	S4VB10	Diode Stack	
D 2	V03C	Diode	
D 3	RD6.8EC	Zener Diode	
D 4	S2VB10	Diode Stack	
D 6	AUO1-12	Zener Diode	
R 2	QRG016J-121	OMF R	
R 5	QRW125J-R47M	WR	
R 6	" -R47M	"	
R 7	" -R47M	"	
R 8	" -R47M	"	
R11	QVP4A0B-102	VR	
R17	QRG026J-(0)	OMF R	
R18	QRG016J-101	"	
R19	" -101	"	
C 1	QFZ0021-154	MY Cap	
C 3	" -104	"	
C 4	QEW71VH-338	E Cap	(3300 μ/35 V)
C 7	QFZ0021-102	MY Cap	
C10	" -104	"	
C12	QEW41CA-227	E Cap	(220 μ/50 V)
RY-1	PU44991	Relay	

Symbol No.	Part No.	Part Name	Description
F 1	QMF51A2-3R15	Fuse	3.15 AT
F 2	QMF51A2-R50	"	500mAT
	A44594-001	Fuse Clip	
	PU44682	Heat Sink	
	PU43351-3	Cap Housing	
	" -4	"	
	" -5	"	
	" -6	"	
	A74067-4X	"	
	" -5X	"	

11-9 ANTENNA SWITCH PRINTED BOARD ASS'Y PU44606A

Symbol No.	Part No.	Part Name	Description
R 1	QRC126J-820	OMF R	
C 1	PU42089	Feed Through Cap	
C 2	"	"	
	PU44605	Lever Switch Ass'y	
	PU44607	Shield Case (AS-1)	
	PU44608	" (AS-2)	
	PU44609	Jack Ass'y	

11-10 DELAY EQUALIZER PRINTED CIRCUIT BOARD PU45448A

Symbol No.	Part No.	Part Name	Description
X 1	2SC829C	Transistor	
X 2	"	"	
DL-1	PU43155	Delay Equalizer	
C 3	QCS11HJ-560	FC Cap	
L 1	A04725-68	Peaking Coil	
	PU43351-5	Cap Housing	

11-11 POWER TRANSISTOR BOARD ASS'Y PU44741

Symbol No.	Part No.	Part Name	Description
X 1	2SD3890	Transistor	
X 2	"	"	
	PU45375-1	Spacer	
	PU41624-6	Insulator	

11-12 RF CONNECTOR

Symbol No.	Part No.	Part Name	Description
C 1	PU42089	Feed Through Cap	
C 2	PU42088	"	
C 3	QCF11HP-103	C Cap	
C 4	PU42089	Feed Through Cap	
C 5	PU42273	"	
	PU44778	RF Shield	
	PU44779	RF Shield Cover	

11-13 TERMINAL BOARD ASS'Y. . MH9301 for (EG)
MH9302 for (EK)

Symbol No.	Part No.	Part Name	Description
	PU45383	Voltage Selector	
	QMF51A2-1R0	Fuse	1 AT
	QSE2135-001	Seesaw SW	
	QMC9017-001	AC Inlet	
	QSS0042-001	Selector SW	B/W-COLOUR
	A43844	Contact	
	PU43252	Aerial Socket	
	GU45073-2	UHF Type Connector	
	QMC0589-001	Din Connector	
	PU46415A	Booster Ass'y	

11-14 JUNCTION BOARD ASS'Y PU44658A

Symbol No.	Part No.	Part Name	Description
X 1	2SC829C	Transistor	
D 1	V03C	Diode	
D 2	"	"	
D 3	MA150LF	"	
D 4	"	"	
D 5			
D 6	MA150	Diode	
D 7	"	"	
R 5	QRG-016J-680	CR	
R 8	PU45352	Thermistor	
R11	"	"	
R13	QRG126J-150	OMF R	
	PU43351-103	Cap Housing	61-63
	" -104	"	51-54
	A74067-5X	"	1-R
	PU43351-6	"	71-76
	PU43092	Collar	for R1 and R13

11-15 TAKE-UP REEL DISK SENSOR ASS'Y
. . . . PU44668A

Symbol No.	Part No.	Part Name	Description
IC 1	DN835	Hall IC	
D 1	RD5.1E	Zener Diode	
C 1	QCF31HP-103	C Cap	
	PU43802	IC Clamp	

11-16 PHOTO TRANSISTOR BOARD ASS'Y

Symbol No.	Part No.	Part Name	Description
	PU44679	Supply Photo Transistor Board	
	PN202S	Photo Transistor	
	PU44897	Shade	
	PU44679	Take-up Photo Transistor Board	
	PN202S	Photo Transistor	
	PU44897	Shade	

11-17 OPERATION BOARD ASS'Y PU44667A

Symbol No.	Part No.	Part Name	Description
	QSM1S01-014	Microswitch	

JVC

Service Manual

SELECT
TIMER SET
TIME ADJ
23:00
HOUR
MIN

TIMER

VICTOR COMPANY OF JAPAN, LIMITED

RT-1 SPECIFICATIONS

Type	24-hour digital indication
Time accuracy	Excellent, locked to power line frequency
Indication	Time, Preset time, Setting indication, Operating indication, Power failure indication
Power source	Applied from the HR-3300E video cassette recorder
Power consumption	1 watt
Dimensions	15.5(W) x 3.7(H) x 2.8(D) cm (6-1/8 x 1-1/2 x 1-1/8 inch)
Weight	Approx. 115 g (0.19 lb)

RT-2 PRECAUTIONS

- This timer is designed to be used only with JVC's model HR-3300E video cassette recorder. It cannot be used with other equipment.
- To adjust the time, lightly press the HOUR and MIN buttons.
  Pressing the button once advances the indication one digit.
- Flickering of the lamp at the right of the dial indicates a power failure.
  The flickering will stop when the time is readjusted.

WARNING:
Unplug the power cord of the HR-3300E before installation to avoid possible shock and damage to sensitive IC circuitry.

* Refer to WARNING in HR-3300E Section 1 regarding copyright of television broadcasts.

RT-3 CONTROLS AND CONNECTORS

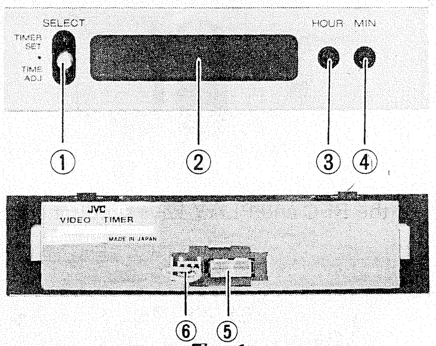


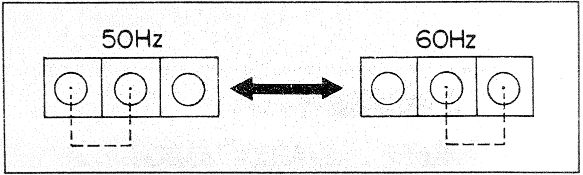
Fig. 1

Front panel

1. SELECT switch
   Hold at the TIMER SET position to set the switch-on time.
   Hold at the TIME ADJ position to adjust the timer to the correct time.
2. Hour/minute dial
   Indicates the time of day when the SELECT switch is at the center position.
   The time-keeping function continues and is memorized internally.
3. HOUR button
   Pressing once advances the time indication by one hour. Adjustment to the correct or switch-on time can be made by repeatedly pressing the HOUR button.
4. Minute (MIN) button
   Pressing once advances the time indication by one minute. Adjustment to the correct time or switch-on time can be made by repeatedly pressing the MIN button.

Rear panel

5. VCR connector
   Connect to the timer connector of the HR-3300E.
6. Cycle change connector.



RT-4 REPLACEMENT OF THE VIDEO TIMER IN THE HR-3300E

Before replacement, be sure to unplug the recorder power cord from the AC outlet.

1. Carefully remove the timer on the recorder by prying gently at both ends with a screwdriver. Place a piece of cardboard between the screwdriver and the front of the recorder to prevent damage to the surface.

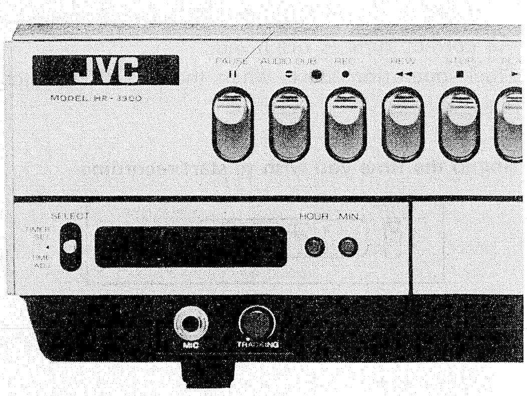


Fig. 2

2. Disconnect the timer connector from the timer.

3. Connect the timer connector to the Timer correctly. Incorrect insertion will cause the built-in fuse of the recorder to blow out.

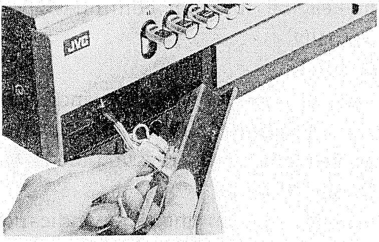


Fig. 3

4. Install the video timer into the receptacle.
5. Plug the recorder power cord into the AC outlet.

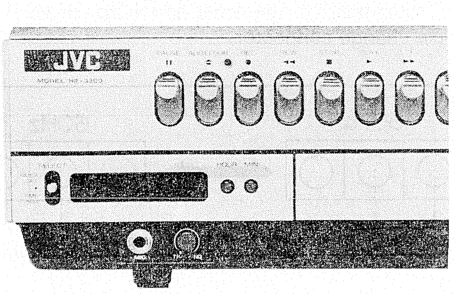


Fig. 4

RT-5 SETTING THE VIDEO TIMER

Setting to the correct time

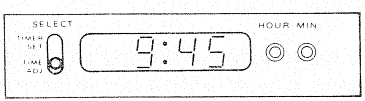

SELECT
TIMER SET
TIME ADJ
9:45
HOUR MIN

Fig. 5

1. Hold the SELECT switch down at the TIME ADJ position.
2. Press the HOUR and MIN buttons repeatedly until the correct time is displayed.
3. Clock operation starts when the SELECT switch is released.

Setting to the time you wish to start recording

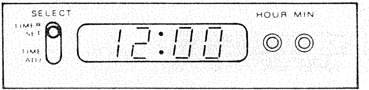

SELECT
TIMER SET
TIME ADJ
12:00
HOUR MIN

Fig. 6

1. Hold the SELECT switch up at the TIMER SET position.
2. Press the HOUR and MIN buttons repeatedly until the desired switch-on time is displayed.
3. When the SELECT switch is released, the hour/minute dial indicates the correct time and the desired switch-on time is memorized.

For accurate time setting

Advance the time indication to one minute ahead of a clock or telephone time recording.

Wait for the time signal while holding the SELECT switch down. Release the SELECT switch at the exact instant of the time signal, and the timer will be set accurately to the correct time.

RT-6 RECORDING DURING YOUR ABSENCE

1. Load the cassette.
2. Set the timer to the desired switch-on time.

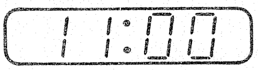


Fig. 7

3. Set the recorder channel selector to the channel you wish to record.

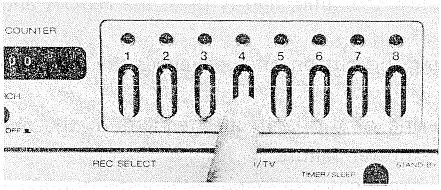

COUNTER
1
2
3
4
5
6
7
8
REC SELECT
TIMER/SLEEP
STAND-BY

Fig. 8

4. Set the REC SELECT switch to TV.

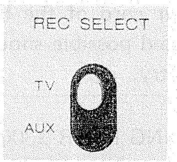

REC SELECT
TV
AUX

Fig. 9

5. Set the operation switch to TIMER/SLEEP.

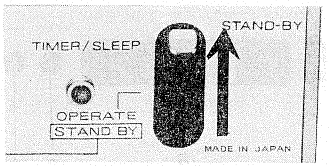

TIMER/SLEEP
STAND-BY
OPERATE
STAND BY
MADE IN JAPAN

Fig. 10

6. Depress the REC and PLAY keys simultaneously.

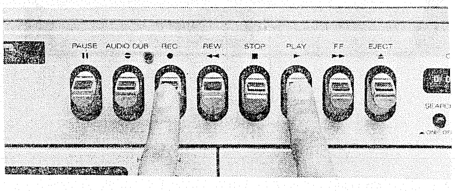
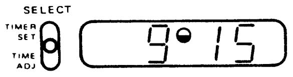
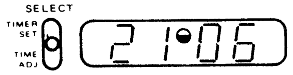
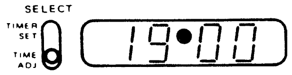
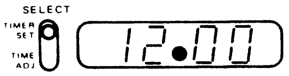
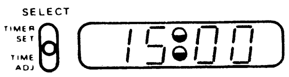
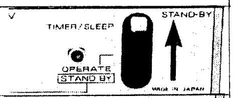
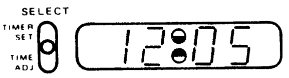
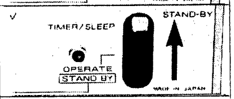
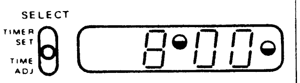

PAUSE
AUDIO DUB
REC
REW
STOP
PLAY
FF
EJECT

Fig. 11

Notes:

- Be careful about the 24-hour time indication.
- Before setting the switch-on time, make sure that the hour/minute dial indicates the correct time.

RT-7 TIMER INDICATION AND FUNCTION

Timer indication	Mode	Function	Power switch on HR-3300E
 SELECT TIMER SET TIME ADJ 9 15	Time	It is 9:15 AM.	
 SELECT TIMER SET TIME ADJ 21 06	Time	It is 9:06 PM.	
 SELECT TIMER SET TIME ADJ 19 00	While setting the time.	The SELECT switch is held down. Adjust to the correct time.	
 SELECT TIMER SET TIME ADJ 12 00	While setting the time you wish to start recording.	The SELECT switch is held up. (To start recording from 12:00, set to 12:00.)	
 SELECT TIMER SET TIME ADJ 15 00	Switch-on time is pre-set.	Recording during your absence at the pre-set time is reserved.	 TIMER/SLEEP STAND-BY OPERATE STAND BY MADE IN JAPAN
 SELECT TIMER SET TIME ADJ 12 05	During recording while absent.	Recording during your absence is taking place.	 TIMER/SLEEP STAND-BY OPERATE STAND BY MADE IN JAPAN
 SELECT TIMER SET TIME ADJ 8 00	Power failure indication.	When a power failure occurs.	

◒ . . . Flickers ● . . . Lights ◒◒ . . . Flicker simultaneously ◒◓ . . . Flicker alternatively

RT-8 DISASSEMBLY

1. Remove four hooks ⑤ of the timer cover ③, then remove it from the front cover assembly ①.
2. Remove a screw ②, then remove the timer printed circuit board.

NOTE: An MOS type IC is employed for IC1 (CK-3300) in the circuit. MOS ICs are extremely fragile and may be very easily destroyed by improper handling. Always observe the following precautions when servicing these units.

1. These ICs are shipped pinned to a conductive foam plastic base. They must not be separated from this base while in storage. If you are using one of several ICs pinned to a common base, remove it from the others by cutting the base. Keep the base attached to the IC until you are ready to mount it.
   Do NOT substitute any other material for the base.
2. There are several precautions to be observed when soldering the new IC into the circuit. Always use a low wattage soldering iron with an isolation transformer. The work bench should be covered with a conductive metal sheet with the chassis under repair grounded.
3. If it is impossible to obtain an isolation transformer, the soldering iron tip, chassis and technician must all be at a common potential.

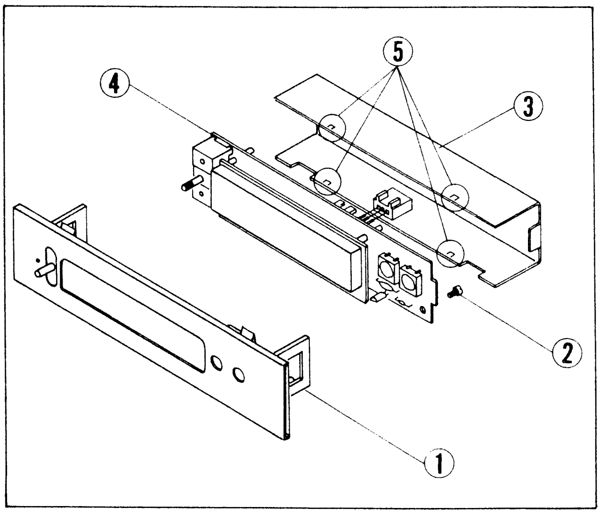
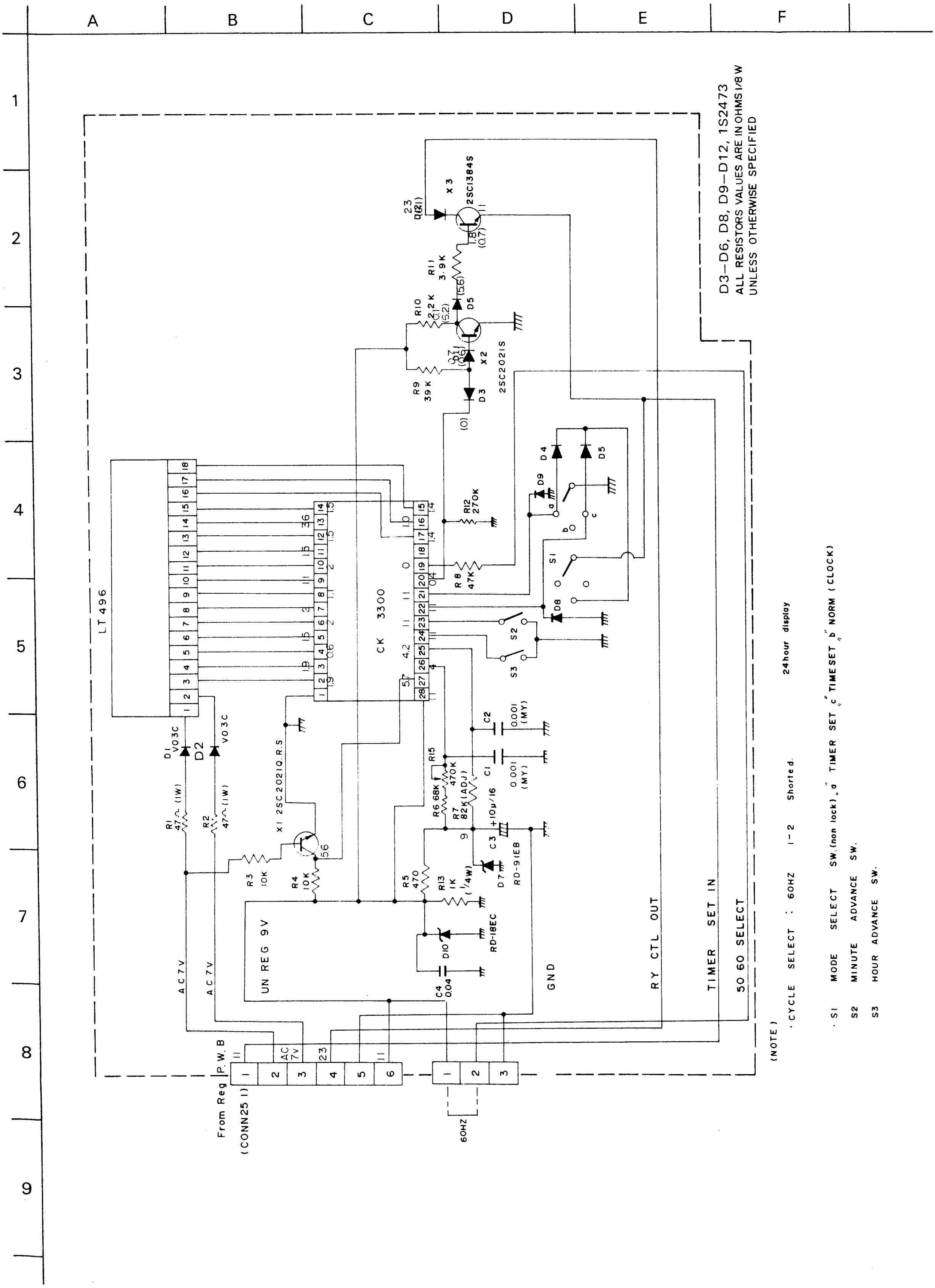


Fig. 12

RT-9 SCHEMATIC DIAGRAM


A
B
C
D
E
F
1
2
3
4
5
6
7
8
9
LT496
CK 3300
X1 2SC2021Q.R.S
X2 2SC2021S
X3 2SC1384S
R1 47Ω (1W)
R2 47Ω (1W)
R3 10K
R4 10K
R5 470
R6 68K
R7 82K (ADJ)
R8 47K
R9 39K
R10 2.2K
R11 3.9K
R12 270K
R13 1K 1/4W
R15 470K
C1 0.001 (MY)
C2 0.001 (MY)
C3 10μ/16
C4 0.04
D1 V03C
D2 V03C
D3
D4
D5
D7 RD-9IEB
D8
D9
D10 RD-18EC
S1
S2
S3
UN REG 9V
GND
RY CTL OUT
TIMER SET IN
50 60 SELECT
AC7V
AC7V
P.W.B
From Reg (CONN25 1)
60HZ

D3–D6, D8, D9–D12, 1S2473
ALL RESISTORS VALUES ARE IN OHMS 1/8W
UNLESS OTHERWISE SPECIFIED

(NOTE)

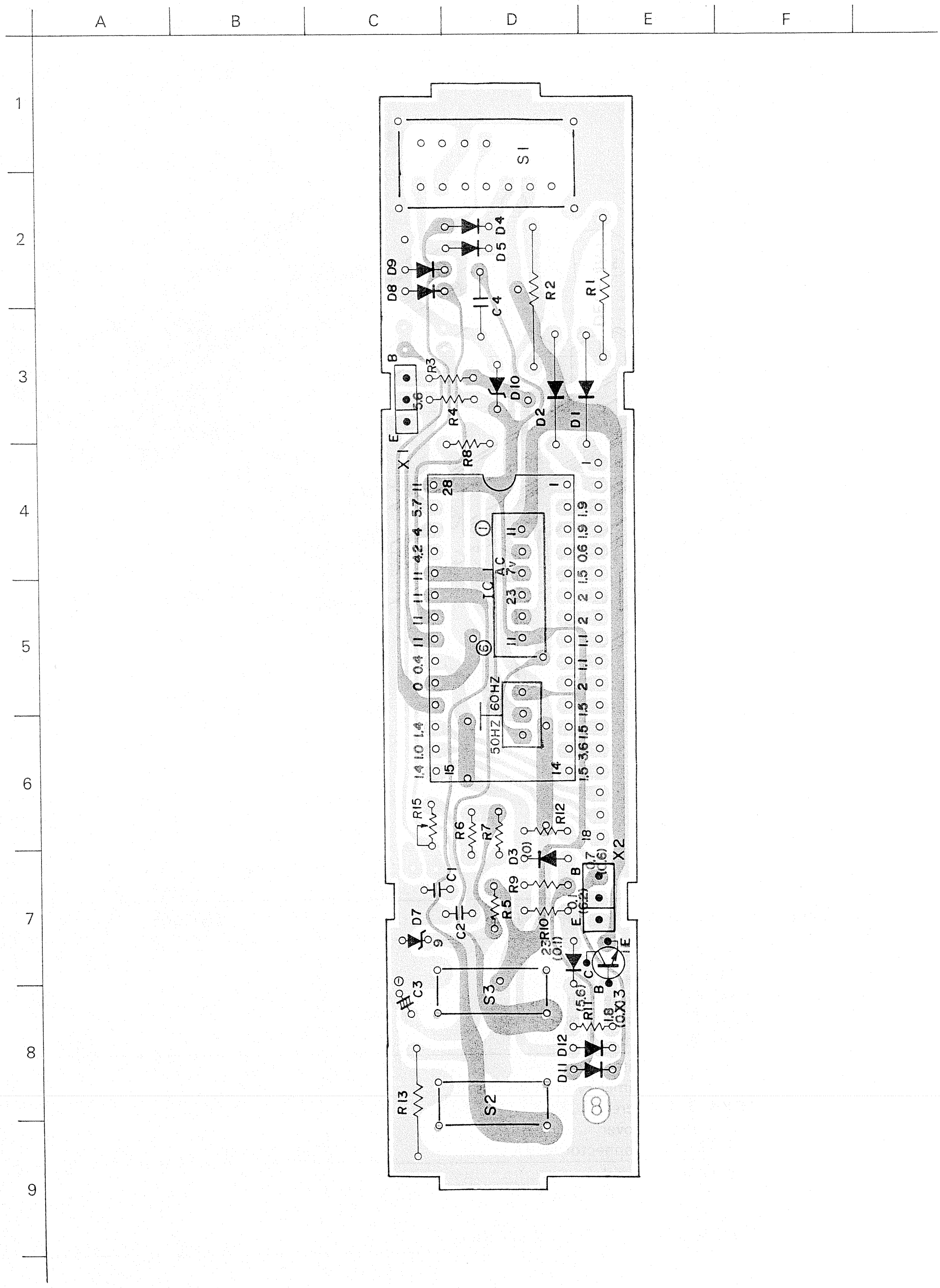
· CYCLE SELECT : 60HZ 1~2 Shorted. 24hour display

· S1 MODE SELECT SW.(non lock), "a" TIMER SET "c" TIMESET "b" NORM (CLOCK)

S2 MINUTE ADVANCE SW.

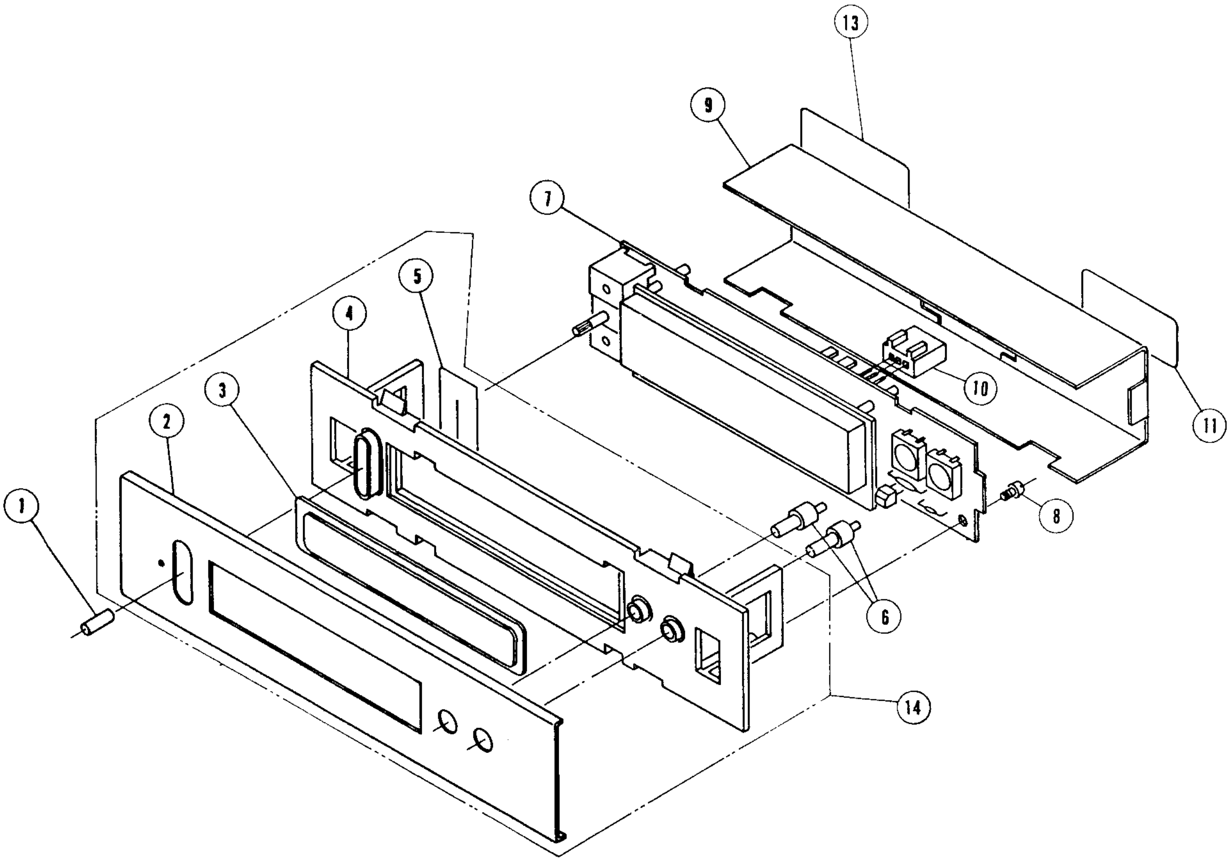
S3 HOUR ADVANCE SW.

RT-10 CIRCUIT BOARD


A
B
C
D
E
F
1
2
3
4
5
6
7
8
9
S1
D4
D5
D8
D9
C4
R2
R1
R3
R4
R8
D10
D2
D1
X1
B
E
5.6
28
1
IC
AC
7V
①
⑥
50HZ
60HZ
23
15
14
R15
R6
R7
R12
D3
R9
R5
R10
C1
C2
D7
C3
S3
S2
R11
R13
D11
D12
X2
X3
⑧

RT-11 EXPLODED VIEW AND PARTS LIST

(Timer ass'y PUS35683-0F)



Symbol No.	Parts No.	Parts Name	Remarks	Q'ty
1	PU45885	Knob		1
2	PU31296	Panel		1
3	PU45884	Timer Window		1
4	PU20608	Front Cover		1
5	PU44737	Sheet		1
6	PU44735	Timer Knob		2
7	PU31465A	Timer P.W. Board Ass'y		1
8	SDSA3006Z	Screw		1
9	PU31468	Cover		1
10	PU43350-3	Connector	3P Connector	1
11	PU45890	Label		1
12	—	—		1
13	PU45921	"		1
14	PU20528B	Front Cover Ass'y		1

RT-12 ELECTRICAL PARTS LIST

Symbol No.	Part No.	Part Name	Description
	PU31465A	Timer P.W. Board Ass'y	
	PU31466	Timer P.W. Board	
LSI	CK-3300		
	PU45880	LSI Socket	
	LT-496	Display	
	PU45877	Push Switch	S2, 3
	PU45878	Lever Switch	S1
X 1	2SC2021QRS	Transistor	
X 2	2SC2021S	"	
X 3	2SC1384S	"	
D 1	V03C	Diode	
D 2	"	"	
D 3	1S2473	"	
D 4	"	"	
D 5	"	"	
D 6	"	"	
D 7	RD-9.1EB	"	
D 8	1S2473	"	
D 9	"	"	
D10	RD-18EC	"	
D11			
D12	1S2473	Diode	

Symbol No.	Part No.	Part Name	Description
R 1	QRG016J-470	CR	
R 2	" -470	"	
R 3	QRD181K-103	"	
R 4	" -103	"	
R 5	" -471	"	
R 6	" -683	"	
R 7	" -823	"	
R 8	" -473	"	
R 9	" -393	"	
R10	" -222	"	
R11	" -392	"	
R12	" -274	"	
R13	QRD141K-102	"	
R14			
R15	PU45903	VR	
C 1	QFM41HK-102	MY Cap	
C 2	" -102	"	
C 3	QEW41CA-106	E Cap	
C 4	QCS31HJ-403	C Cap	
	PU43092	Collar	
	PU43351-6	Cap Housing	
	PU45380-3	"	
	GK35050	Caution Label	